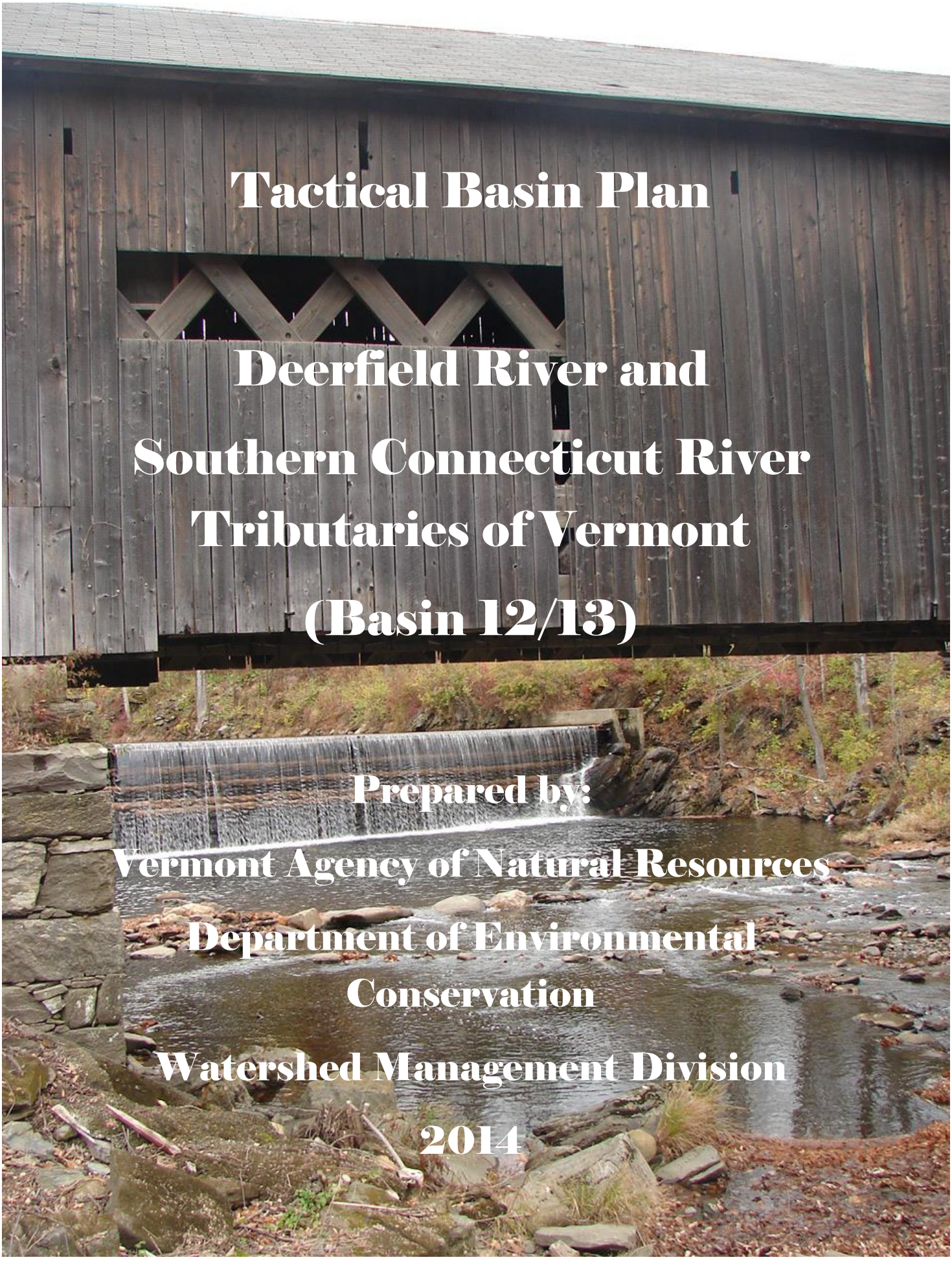

Tactical Basin Plan

Deerfield River and Southern Connecticut River Tributaries of Vermont (Basin 12/13)

Prepared by:

Vermont Agency of Natural Resources

Department of Environmental Conservation

Watershed Management Division

2014

This Water Quality Management Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards, the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water Management Strategy.

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Cover Photo: Green River covered bridge & crib dam, by Josh Gorman

Approved[1]:

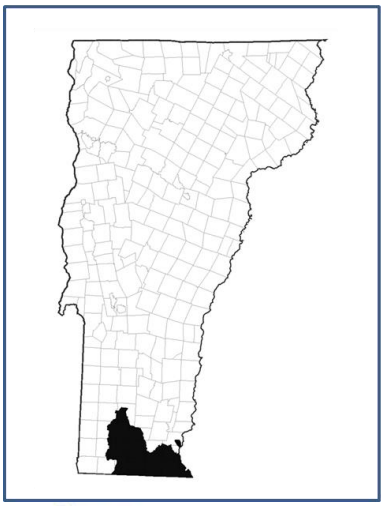
David Mears, Commissioner — Date: 3/11/14

Deb Markowitz, Secretary — Date: 3-11-14

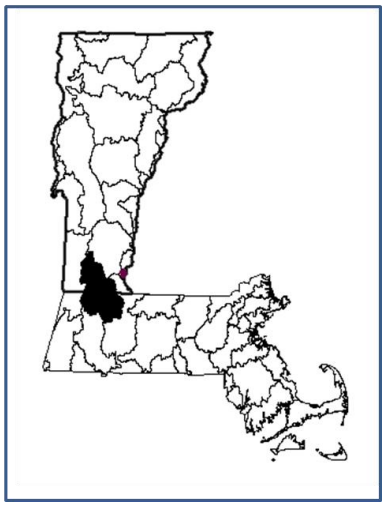
[1]) Pursuant to Section 1-02 D (5) of the VWQS, Basin Plans shall propose the appropriate Water Management Type of Types for Class B waters based on the exiting water quality and reasonably attainable and desired water quality management goals. ANR has not included proposed Water Management Types in this Basin Plan. ANR is in the process of developing an anti-degradation rule in accordance with 10 VSA 1251a (c) and is re-evaluating whether Water Management Typing is the most effective and efficient method of ensuring that quality of Vermont's waters are maintained and enhanced as required by the VWQS, including the anti-degradation policy. Accordingly, this Basin Plan is being issued by ANR with the acknowledgement that it does not meet the requirements of Section 1-02 D (5) of the VWQS.

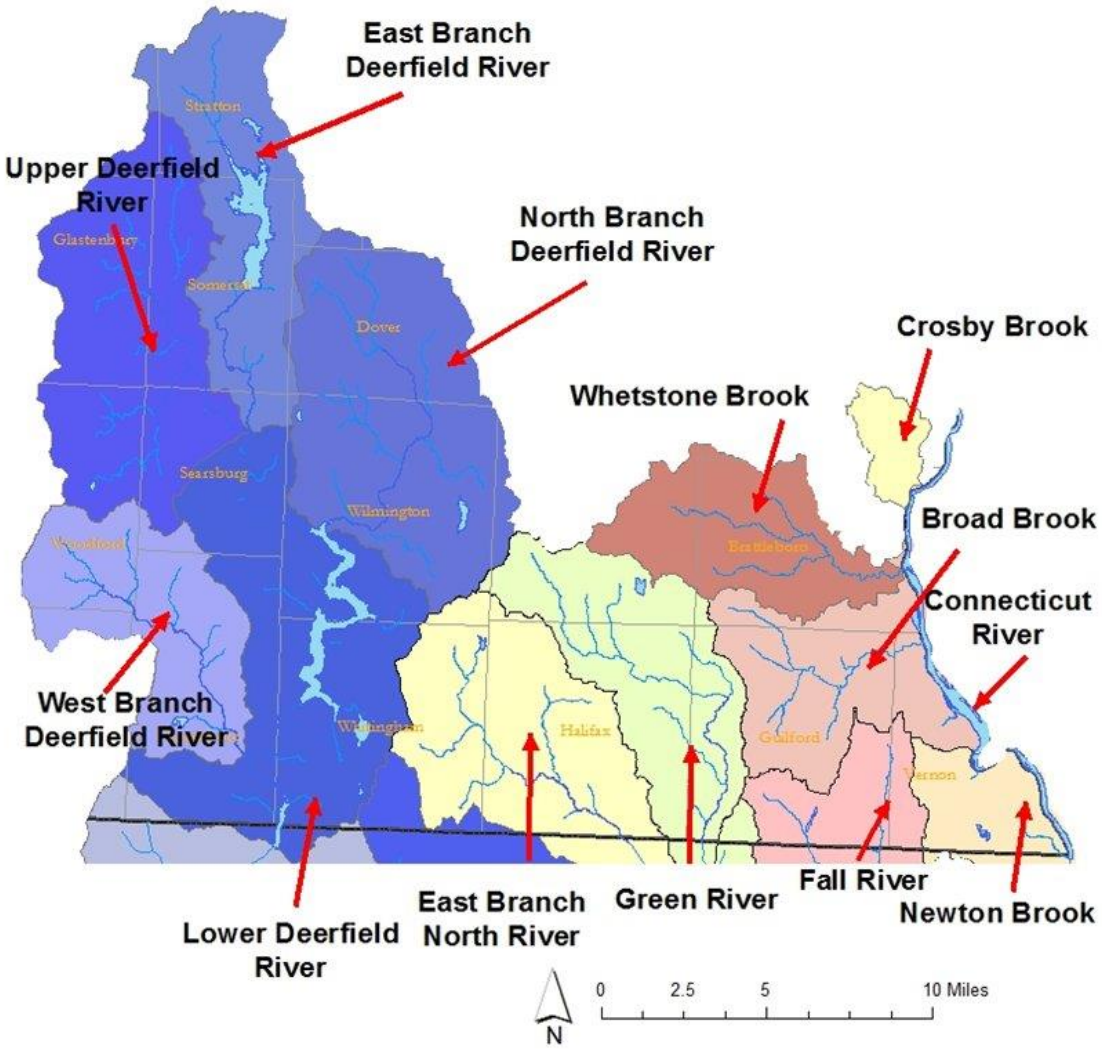
BASIN 12-13

The Deerfield River and Lower Connecticut River Tributaries



The Deerfield River in Vermont and Massachusetts





All Basin 12 – 13 Towns

Brattleboro
Dover
Dummerston
Glastenbury
Guilford
Halifax
Marlboro
Readsboro
Searsburg
Somerset
Stamford
Stratton
Sunderland
Vernon
Wardsboro
Whitingham
Wilmington
Woodford

Towns in Major Sub-watersheds

Deerfield River Watershed

Deerfield
Dover
Glastenbury
Readsboro
Searsburg
Somerset
Stamford*
Stratton
Sunderland
Wardsboro*
Whitingham
Wilmington
Woodford

Green River
Brattleboro*
Guilford
Halifax
Marlboro
Wilmington*

North River – East Branch
Halifax
Marlboro*
Whitingham
Wilmington

Connecticut River Watershed

Connecticut
Brattleboro*
Dummerston
Vernon

Crosby Brook
Brattleboro
Dummerston

Whetstone Brook
Brattleboro
Dummerston*
Marlboro

Broad Brook
Brattleboro*
Guilford
Vernon

Fall River
Guilford
Vernon

* - towns with small areas in each watershed

Table of Contents

List of Tables

List of Figures

Executive Summary

The Deerfield River and lower Connecticut River valleys offer exceptional beauty, support diverse water-related recreation and industry and face some considerable water quality related stresses. Water recreation offers still and whitewater boating, swimming and fishing opportunities along with wildlife viewing in areas with high concentrations of rare, threatened and endangered species. The use of the rivers for hydroelectric and nuclear power production provides economic benefits yet introduces challenges to the water quality and aquatic habitat by altering water temperatures and flows. Resort development encroaches on waterways, withdraws water for snow-making and creates excess stormwater runoff while offering four-season recreational activities, employment and tourism. The region is a complex mix of land uses and land use goals.

This Water Quality Management Plan provides a watershed-wide perspective on the health and condition of the water quality and aquatic resources of the basin. As the tactical, or implementation, portion of the **Vermont Surface Water Monitoring Strategy** it offers clear actions to protect, maintain, and improve surface waters by managing the activities that cause the known stressor(s) and address the resulting pollutants. Priority has been given to those waters that are identified as facing the greatest challenges due to either degraded conditions already present or the exceptional quality and characteristics that should be protected.

Tropical Storm Irene occurred in 2011 and hit this region with astonishing intensity. The towns of Wilmington and Brattleboro had their downtowns flooded, businesses and homes destroyed and infrastructure overwhelmed. No town was spared but Dover, Whitingham, Halifax and Guilford also received heavy damage. The flooding and erosive damage will remain visible for decades but the rivers' response has been to re-create lost floodplains, increase sinuosity and re-distribute sediment throughout the valleys. The new river channels and patterns, if allowed to remain, will offer some mitigation of future flood events.

Future attention to building with flood resiliency in mind will also move the region toward a more sustainable co-existence with our rivers. A number of implementation actions are direct responses to the flooding in order to move in this direction.

Strategies address both overall regional water quality issues as well as specific actions on targeted waters. The North Branch of the Deerfield, Whetstone and Crosby Brooks in Brattleboro and Newton Brook in Vernon are highlighted for their **impaired** [2]status and the need to bring these waters back into compliance with the Vermont Water Quality Standards (VWQS).

The goal is to carry out these actions over the next five years to bring improvements and protections to the regions surface waters.

Top 10 actions

- Incorporate Fluvial Erosion Hazard corridors and flood resiliency strategies into regional development plans and municipal zoning.
- Develop and implement a **Water Quality Remediation Plan** for Mount Snow.
- Work with the Mount Snow and Hermitage resort, the towns of Dover & Wilmington and the community to address high *E. coli* levels causing impairments, to the North Branch of the Deerfield River.
- Protect the land and habitat along the Connecticut River to enhance survival of the high concentration of RTE species.
- Conduct a Stream Geomorphic Assessment of the East Branch of the North River.
- Reduce sediment impacts to Crosby Brook.
- Implement recommendations of the Bacteria TMDL to control high levels of bacteria in Whetstone Brook.
- Remove Tri-Park trailers in Mountain Home Park that are under agreement to be removed from the Whetstone Brook floodway.
- Address agricultural runoff pollution along Newton Brook and the Connecticut River in Vernon.

[2] Words in **Bold** are defined in the Glossary

- Work with VDFPR, VDFW, the Town of Vernon and local partners to evaluate Atherton Meadows pond and wetland and Vernon's black gum wetlands for potential Class 1 reclassification.

Summary of classification opportunities.

Water recommended for reclassification to Class A(1):

- East Branch Deerfield and tributaries, above Somerset Reservoir
- West Branch Deerfield, entire basin
- Deerfield River and tributaries above confluence with East Branch
- Green River, entire basin
- All waters in GMNF Wilderness Areas below 2500 feet
- Grout Pond
- Stamford Pond
- Lost Pond

Water identified as Very High Quality:

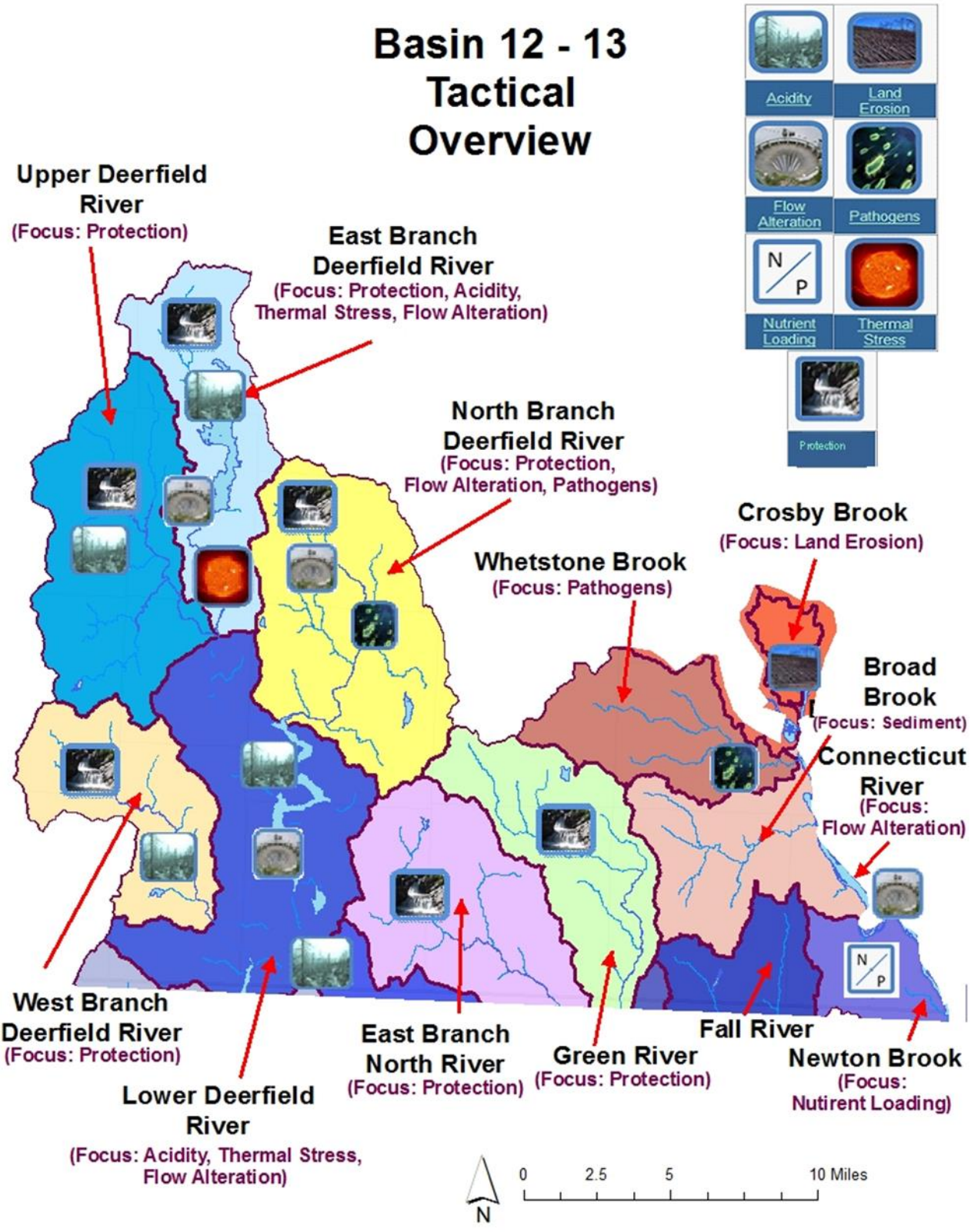
- East Branch North River – above the Jacksonville WWTF
- All waters recommended for A(1) reclassification

Water recommended for evaluation as prospective Outstanding Resource Waters:

- Grout Pond
- Lily Pond
- Lake Raponda
- Halifax Gorge

Wetlands proposed for study to determine Class 1 potential:

- Vernon, black gum swamps
- Somerset/Stratton, Deerfield River riparian wetland complex
- Somerset/Stratton, wetland complex east of Somerset Reservoir
- Somerset, Grout Pond wetland complex
- Whitingham, Atherton Meadows
- Whitingham, floating bog in Sadawga Pond.


Basin 12 - 13
Tactical
Overview
Acidity
Land Erosion
Flow Alteration
Pathogens
N
P
Nutrient Loading
Thermal Stress
Protection
Upper Deerfield River
(Focus: Protection)
East Branch Deerfield River
(Focus: Protection, Acidity, Thermal Stress, Flow Alteration)
North Branch Deerfield River
(Focus: Protection, Flow Alteration, Pathogens)
Crosby Brook
(Focus: Land Erosion)
Whetstone Brook
(Focus: Pathogens)
Broad Brook
(Focus: Sediment)
Connecticut River
(Focus: Flow Alteration)
West Branch Deerfield River
(Focus: Protection)
Lower Deerfield River
(Focus: Acidity, Thermal Stress, Flow Alteration)
East Branch North River
(Focus: Protection)
Green River
(Focus: Protection)
Fall River
Newton Brook
(Focus: Nutirent Loading)
N
0
2.5
5
10 Miles

Chapter 1. Introduction

1. Setting and Purpose of this Plan

The Deerfield River rises in the Green Mountains in the towns of Glastenbury and Stratton in the southern part of Vermont. It flows through south central Vermont and cross the Vermont-Massachusetts border before it joins the Connecticut River. The Deerfield River has four branches in Vermont: North Branch, South Branch, East Branch and West Branch. Two of the Deerfield's main tributaries, the East Branch of the North River and the Green River, originate in Vermont and enter the Deerfield River in Massachusetts. The Deerfield River system, including the East Branch of the North River and the Green River, drains 14 Vermont towns in two counties and is about 318 square miles in area. The Deerfield River watershed is designated as Planning Basin 12.

Draining directly into the Connecticut River from the towns of Brattleboro, Dummerston, Guilford and Vernon, on south to the Massachusetts line are Broad, Crosby, and Whetstone Brooks and the Fall River. Broad Brook drains 23.8 square miles; Crosby Brook 5.7 square miles; Whetstone Brook 25.5 square miles; and the Vermont portion of the Fall River, 10.4 square miles. These waters make up a portion of Planning Basin 13.

The Vermont Department of Environmental Conservation's (VDEC) tactical planning process is designed to identify and prioritize state and local water quality issues and implement on-the-ground watershed protection and restoration projects. Plans are designed to meet the goals and objectives of the Vermont Surface Water Management Strategy [3] to protect, maintain and restore the biological, chemical, and physical integrity, and public use and enjoyment of Vermont's water resources, and to protect public health and safety. The VDEC collaborates with state, federal and municipal organizations, local conservation groups, businesses, and a variety of landowners and interested citizens to develop the water quality management plan for waters in these Basins.

Partners in the planning process include:

- Bennington County Conservation District
- Bennington County Regional Commission
- Connecticut River Joint Commissions
- Connecticut River Watershed Council

[3] http://www.anr.state.vt.us/dec/waterq/swms.html

- ConnecticutRiver.us
- Deerfield River Watershed Association
- Friends of the Green River
- Lake Raponda Association
- Lake Sadawga Association
- Municipalities of Brattleboro, Dover, Dummerston, Glastenbury, Guilford, Halifax, Marlboro, Readsboro, Searsburg, Somerset, Stamford, Stratton, Sunderland, Vernon, Wardsboro, Whitingham, Wilmington, Woodford
- Southeastern Vermont Watershed Alliance
- Southern Vermont Natural History Museum
- TransCanada Hydro Northeast Inc.
- USDA
    - Forest Service and
    - Natural Resources Conservation Service
- VT Agency of Natural Resources Departments of
    - Environmental Conservation
    - Fish and Wildlife and
    - Forests, Parks and Recreation
- VT Agency of Transportation
- Windham Natural Resources Conservation District
- Windham Regional Commission

2. Expected Implementation Process

This Plan lays out a table of implementation strategies based on clear goals and objectives. Each targeted project is aimed at addressing a specific stressor or threat to local surface waters or at protecting the high quality of waters that currently exists. Planned projects are designed to be targeted, iterative and adaptive meaning that this initial plan focuses on priority projects that address the most pressing issues first. As these projects are implemented and progress is made toward water quality improvement and protection another set of projects will be identified in the next version of the Plan that will go forward and continue to work throughout the watershed.

This process has highlighted the North Branch of the Deerfield River, Crosby, Whetstone and Newton Brooks as the highest priority waters for restoration work and West Branch of the Deerfield, Glastenbury River and Green River for high quality water protection.

Chapter 2. Water Quality in the Basin

1. Summary of Surface Water Assessments

The Agency and its partners have conducted on-going monitoring and assessment throughout the Basin. Water quality, biological and physical assessments have been completed on many of the rivers, streams and lakes. Stream geomorphic assessment has been completed or is underway in four subwatersheds, and stormwater inventories and illicit discharge and detection efforts have been carried out in two subwatersheds. These efforts, as well as those planned for execution during the implementation of this Plan are detailed in Table 1.

Geomorphic assessments integrate watershed-wide physical stream characteristics from maps, aerial photographs, existing studies, and field data on the geographic, geologic, and hydrologic factors of the stream channel and floodplain characteristics. This information reveals equilibrium departures, ongoing channel adjustments, and provides a detailed characterization of riparian and in-stream habitat, stream-related erosion, and flood hazards for use in watershed planning. Table 2 and Figure 1 show the locations and links for those completed or underway in the Basin.

The Ambient Biomonitoring Program of WSMD measures the macroinvertebrate and fish communities of rivers and streams in order to evaluate the biological health, or biological integrity of rivers and streams. These surveys are used for detecting aquatic life impairments and assessing their relative severity. Biomonitoring assessments indicate the overall ecological integrity of the river system and provide a method of evaluating waters in comparison to their "reference" condition without human impacts. This program also collects water quality data that are used to assess compliance with Water Quality Standards. The biological and water quality results are used to rank the condition of waters as *Excellent, Very Good, Good, Fair or Poor*, using the Department's Procedures for Ambient Biomonitoring and Assessment.

The Lake Assessment Program of WSMD performs similar functions for lakes and ponds, and numerous lakes and ponds have been assessed in this Basin. Figure 2 shows monitoring locations for both programs, and provides an assessment of current biological integrity for streams. The condition of lakes is described separately in this Chapter.

A comprehensive summary of available assessment information from all of these processes is compiled into the Basin Water Quality Assessment Report which details the conditions on a sub-watershed and reach level.

Table 1. Status of completed and planned assessments for the Deerfield River and adjacent Connecticut River Watersheds

	X = proposed in plan, C = Completed, PC = Partial Completed, O = On-going, U = Underway, P = Planned, N = Not planned							
	Sub-Basin	**Geomorphic Assessment**	**Water Quality Monitoring**	**Bio-monitoring (completed / planned)**	**Agricultural Environmental Management Assessment**	**Stormwater Inventory & Illicit Discharge Detection**	**Status: Listed / Pollutant**	**Full or Partial reach listed?**
Deerfield River								
MAINSTEM	**Glastenbury River to headwaters**	N	O	2009 / 2016				
	Searsburg Reservoir inlet to Glastenbury River	N	O	2009 / 2016				
	Harriman Reservoir inlet to Searsburg Reservoir	N	O	2009 / 2016			Part A (acid) Part D (mercury)	Full
	Lower Deerfield from MA line to Harriman Reservoir	N	O	2009 / 2016		P	Part F (low temperature)	Partial
TRIBUTARIES	**Glastenbury River**	N	O	2009 / 2016				
	East Branch Deerfield River	N	O	2009 / 2016		P	Part A (acid)	Partial
	North Branch Deerfield River	O	O	2009 / 2016	X	P	Part A (stormwater) Part D (approved TMDL for E. coli) Part F (low flow)	Partial
	♦ **Ellis Brook**	X	O	2009 / 2016			Part C (undefined)	Full
	West Branch Deerfield River	N	O	2009 / 2016				
	South Branch Deerfield River	N	O	2009 / 2016				
	Green River	U	O	2009 / 2016				
	♦ **Hinesburg Brook**	U	O	2009 / 2016	X			
	East Branch North River	X	O	2009 / 2016				
Connecticut River								
MAINSTEM	**Reach 13-03 – Crosby Brook to West River confluence**	N	N	2009 / 2016			Part F (altered flow regulation)	Full
	Reach13- 04 – West River confluence to Vernon Dam	N	N	2009 / 2016	X		Part F (altered flow regulation)	Full
	Reach13- 05 – Vernon Dam to MA line	N	O	2009 / 2016	X		Part C (tritium) Part F (altered flow regulation)	Full
Connecticut River Direct								
TRIBUTARIES	**Broad Brook**	X	O	2009 / 2016				
	Central Park Brook	N	O	2009 / 2016				
	Crosby Brook	C	O	2009 / 2016		C	Part A (needs TMDL for sediment)	Partial
	Fall River	N	X	2009 / 2016				
	Keets Brook	N	X	2009 / 2016				
	Newton Brook	X	O	2009 / 2016	X		Part A (needs TMDL for sediment)	Partial
	Whetstone Brook	C	O	2009 / 2016	X	C	Part D (approved TMDL for E. coli)	Partial

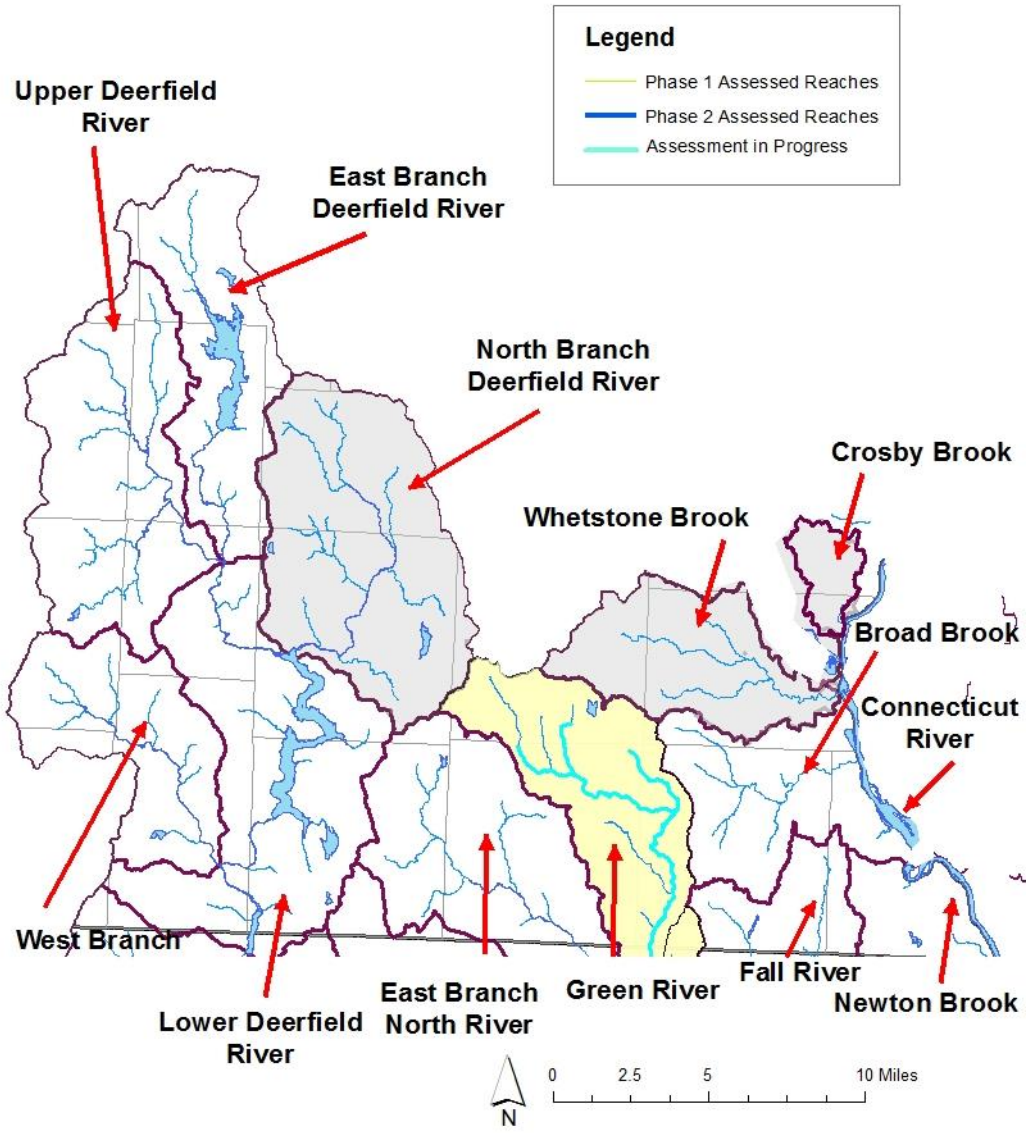


Figure 1. *Stream Geomorphic Assessments in the Deerfield and Adjacent Connecticut River Watersheds.*

Table 2. Stream Geomorphic Assessments in the Deerfield and Adjacent Connecticut River Watersheds

Subwatershed	Date	Link to report
North Branch Deerfield River	2006 and 2013	North Branch of Deerfield River Phase 1 & 2 SGA and Corridor Plan
Green River and Hinesburg Brook	Underway	
Crosby Brook	2009	Crosby Brook Restoration Plan
Whetstone Brook	2008	Whetstone Brook Watershed Corridor Plan

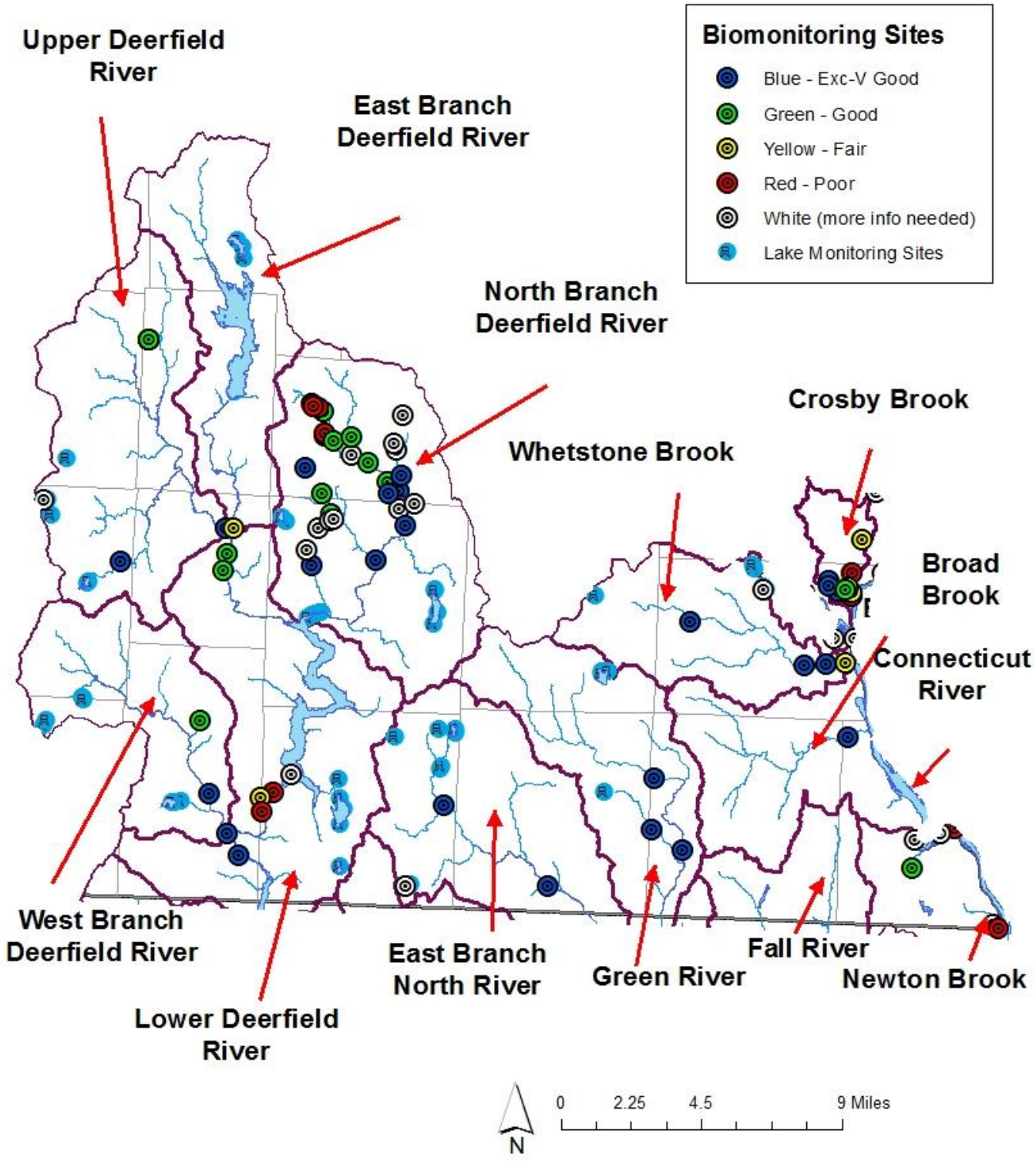


Figure 2. *Biological condition at streams monitoring sites and lake monitoring site locations.*

2. Water quality, biological condition, habitat, and geomorphic condition of specific subwatersheds

Deerfield River

Upper Mainstem – above Searsburg Reservoir

Tributaries entering the river above Searsburg including Blind, Deer Lick, Deer Cabin Brooks and the Glastenbury River. The mainstem and numerous ponds are listed as impaired for high levels on acid from atmospheric deposition (acid rain). Elevated mercury levels have been found in fish. While production in these high elevation waters is naturally limited by chemistry and temperatures they nonetheless support naturally reproducing populations of wild Brook Trout. Lack of riparian buffers contributes to summer seasonal water temperatures that degrades coldwater fish habitat.

Lower Mainstem – below Searsburg Reservoir

From the Searsburg Reservoir downstream well into Massachusetts, water level manipulation for hydroelectric generation on the Deerfield River causes stress to the river system. The three dams in Vermont create both cold and warm thermal stresses, alter the natural course and flow of the river and alter the sediment transport downriver. These conditions are reflected in the varying water quality ratings along its course.

Biomonitoring sites in Searsburg above and below the Searsburg Reservoir show *Very Good to Good* for Aquatic Life Support respectively. The mainstem immediately below Harriman Reservoir is rated as *Poor* for Aquatic Life Support and gets progressively better toward the head of Sherman Reservoir where it rates *Excellent*. This reach is still listed as impaired however due to low temperature from the cold water released from the deep intake at Harriman Dam. This condition inhibits fish growth and productivity. Tributaries entering the reach include the South Branch which is **stressed** due to low alkalinity and pH, and the West Branch, which is similarly stressed with added threats from seasonal warm temperatures due to the lack of riparian buffers.

East Branch Deerfield

The East Branch enters, flows through and drains Somerset Reservoir joining the mainstem just north of Searsburg Reservoir. There are no biomonitoring sites on this reach but, like other area waters, it is impaired for acid and mercury. As above, fish production is inhibited by the cold water discharge from the dam.

North Branch Deerfield

The North Branch has had extensive monitoring to support management of ski resort and related development in the watershed. Monitoring also covers Blue, Cheney, Cold, Beaver, Ellis, Haystack, Negus and Rose Brooks among others. Much of the watershed was heavily damaged by Tropical Storm Irene in 2011.

Aquatic Life Support ratings above the Mt. Snow Resort are *Excellent*, while ½ mile downstream the rating drops to *Fair-Poor*. It begins to recover a mile further down and attains *Very Good* status 4.5 miles later. The causes of these impacts include high levels of sand and sediment, high iron levels and erosion and channelization of stream channels. Stormwater effects from Mount Snow development impair the river below the resort area and water withdrawals for snowmaking leave minimal flow in the stream during winter altering natural flows below and where it is impounded into Snow Lake and Carinthia Pond.

The river in the vicinity of West Dover has high levels of *E. coli* bacteria which impair contact recreation. This reach is subject to the Total Maximum Daily Load (TMDL) for bacteria. The *North Branch – Deerfield Bacteria TMDL* identifies sources including leaking sanitary sewer pipes, stormwater runoff from developed areas, and failing or malfunctioning septic systems as contributors of bacteria. In Dover "sewer lines entering the treatment plant cross over the North Branch at several locations. The facility and sewer pipes that carry the wastewater were constructed in the 1970's (Dover, 2008) and given the age of the infrastructure, leaks within the sanitary sewer pipes could pose a significant *E. coli* source if failure were to occur." More information is provided by the Vermont Statewide TMDL for Bacteria-Impaired Waters Final Document, specifically, Appendix 16-No Branch-Deerfield.

Ellis Brook needs further assessment to determine why the macroinvertebrate and fish community ratings have dropped.

Beaver Brook is considered stressed due to excessive sediment inputs.

Binney, Cold and Rose Brooks are also stressed by the impacts of land development. Despite these stresses, these tributaries continue to host populations of wild Brook Trout.

Recent proposals for redevelopment of the Haystack/Hermitage resort on Cold Brook are undergoing regulatory review in conjunction with several programs, including: Act 250; Stream Alteration; Wetlands; Water Supply; Wastewater; the US Army Corps of Engineers dredge and fill program; and, as appropriate DEC's authority under §401 of

the Clean Water Act. Through this process, the need for a a Water Quality Monitoring Plan to document any changes to water quality as a result of the land use changes will be determined.

Deerfield River Chain

(Grout Pond, Somerset Reservoir, Harriman Reservoir, Sherman Reservoir, and Searsburg Reservoir)

Due to high levels of mercury in fish tissue the Vermont Department of Health posts a Health Alert for Fish Consumption for the Deerfield River chain recommending the following:

	Women of childbearing age and children age 6 and under	**Everyone else**
Brook Trout Brown Bullhead	No more than 5 meals/month	No Restrictions
Brown Trout (14 inches and smaller) Rainbow Smelt Rainbow Trout Rock Bass Yellow Perch	No more than 1 meal/month	No more than 3 meals/month
Brown Trout (larger than 14 inches) All Other Fish	0 meals	No more than 1 meal/month

Green River

The Green River is a major tributary to the Deerfield joining it in Greenfield, Massachusetts less than two miles from the Connecticut River. The 35 square mile Vermont portion of the watershed is relatively undeveloped and hence is in very good condition. Aquatic Life Support ratings are consistently in the *Very Good to Excellent* range with the exception of a sampling done immediately post-Irene. The fishery supports wild Brook Trout populations and the fish ladder at the crib dam in Green River village allows passage of several species of fish.

East Branch of the North River

The North River is also a cross border river meeting the mainstem of the North River in Colrain, Massachusetts and entering the Deerfield just north of Shelburne Falls. The East Branch's 41 square mile, Vermont portion of the watershed has more agricultural land use than the Green River and Route 112 runs adjacent to the river for much of its course. Aquatic Life Support ratings are consistently in the *Very Good to Excellent* range again with the exception of sampling immediately post-Irene. The fishery is stressed by warm summer temperatures likely due to the lack of riparian buffers.

Connecticut River

The mainstem of the Connecticut River is not consistently monitored by the Ambient Biomonitoring Program, due in part to its size, and also since much of the river is located in New Hampshire, and is monitored with some regularity by the New Hampshire Department of Environmental Services. There are several Vermont monitoring sites however with one not far below the Vernon Dam. The river from the Massachusetts line on north is altered due to water level fluctuations generated by the Vernon and Bellows Fall hydroelectric power stations. The natural flow of river is impounded by the dams from the Turners Falls Dam in Massachusetts to well above the Bellows Falls Dam in Rockingham.

The river is also under a Total Maximum Daily Load for nitrogen, which creates an anoxic "dead-zone" in Long Island Sound. New Hampshire lists this reach as marginally impaired for Aquatic Life Support due to aluminum, copper and pH. The Connecticut River receives treated effluent from several wastewater treatment facilities, and also provides cooling water withdrawal and warm water release from the Entergy Vermont Yankee Nuclear Power Facility (ENVY). Numerous monitoring studies are carried out in conjunction with the operation of ENVY, including thermal monitoring, and fish impingement and entrainment studies.

The lower Connecticut River valley in Vermont has a high concentration of rare, threatened and endangered (RTE) species due in part to it being at the northern edge of the range on numerous southern species. The river valley itself makes up the Middle Connecticut River Important Bird Area (IBA) for its recognition as an important corridor for migrating birds.

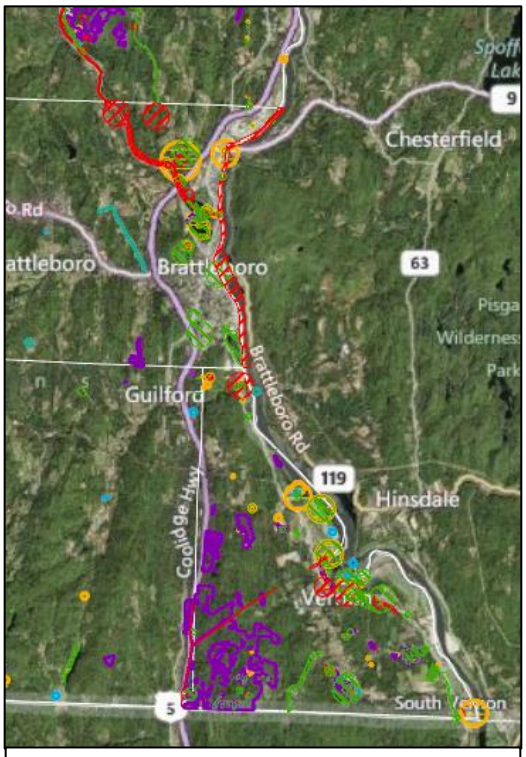


Figure 3. *RTE concentration along the Connecticut River.*

Fall River

The mainstem of the Fall River runs south parallel to I-91 and below the VT/MA border is joined by Couch Brook which drains Sweet Pond and Weatherhead Hollow Pond. The watershed at this junction is just over 16 square miles in size. Initial biomonitoring was done in 2013 and results are pending.

Sweet Pond is presently drained due to structural problems with the dam. The VDFPR is evaluating the future of the dam and pond with the intention of re-building the dam, though funds have not yet been identified for the purpose. Water quality and habitat issues associated with the reconstruction will be evaluated by VDEC during this process.

Crosby Brook

Crosby Brook is a small tributary draining directly into the Connecticut River just below the Putney Road roundabout in Brattleboro. Aquatic life use in the lower segment of Crosby Brook is impaired due to excess sediment and is a medium priority for TMDL development (Figure 3). The brook is also stressed due to high temperatures. The mainstem above the Putney Road developed area is assessed as *Excellent to Very Good* for Aquatic Life Support while below the development just before it reaches the Connecticut River, it is only *Fair to Poor* (Figure 5). The fish community reflects this progression as well. The South Branch rating drops from *Excellent* one mile above I-91 to *Good* just below it. In addition to sedimentation, the 0.7 miles impaired section exhibits impacts due to habitat alterations, temperature, runoff, channelization, and loss of riparian vegetation.

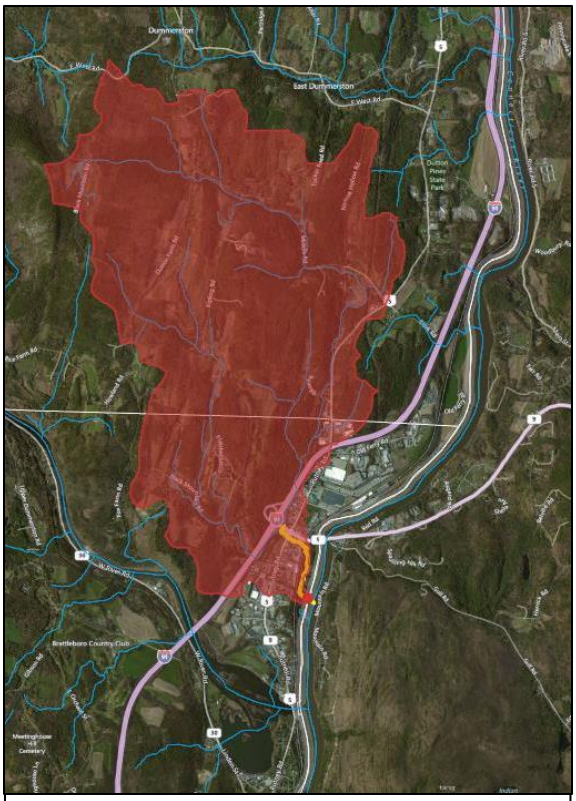


Figure 4. *Crosby Brook watershed, showing the impaired reach in yellow.*

Significant work has been done by the state Agencies of Natural Resources and Transportation, the Windham County Natural Resources Conservation District and the Town of Brattleboro to remediate the sediment inputs to the brook. The next round of monitoring will reveal what level of success this work has achieved. Projects selected for implementation were developed through the Crosby Brook Stream Corridor Restoration Plan (pdf, 4.26 MB).

A stormwater study, the Crosby Restoration Study Project, was recently completed covering the Route 5/Putney Road corridor, Interstate 91 and the Exit 3 cloverleaf areas, to develop conceptual designs for Stormwater Treatment Practices that will be selected to handle stormwater runoff that will provide the most beneficial, cost effective and most protective alternatives for minimizing direct discharge of un-treated runoff and potential spills into the brook. This study was done in preparation for reconstruction of Route 5 by VAOT and upgrades to Putney Road by the Town of Brattleboro.

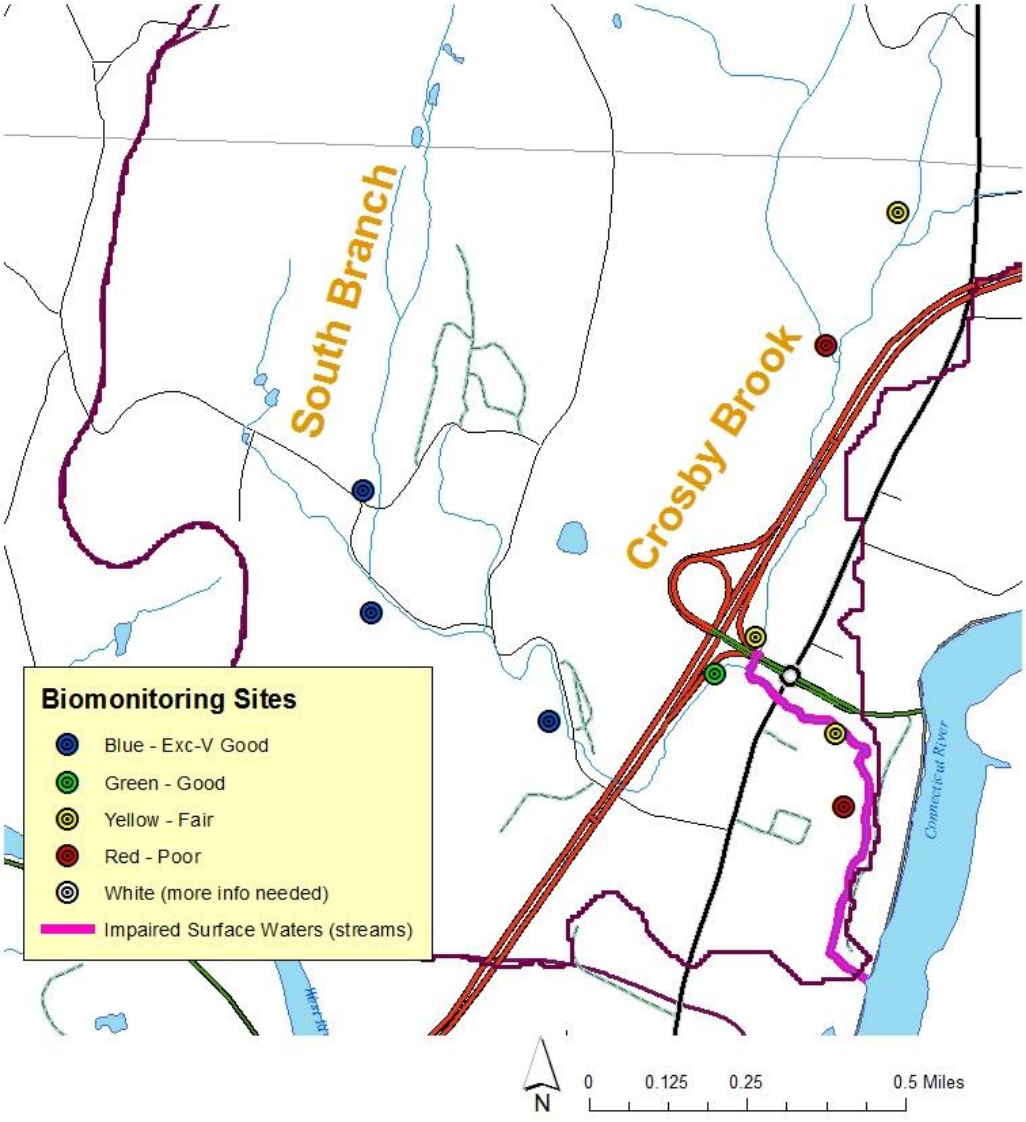


Figure 5. *Biological assessment of the Crosby Brook with focus on the impaired reach.*

Whetstone Brook

Running from the hills of Marlboro and through Brattleboro, Whetstone Brook is also on the impaired waters list (Table 6). High levels of bacteria impair the brook for contact recreation for the lower 2.2 miles from the mouth up to the Creamery Bridge. Then for 2.5 miles above the Creamery Bridge up to Westgate, the brook is stressed for aquatic biota/habitat, secondary contact recreation, and aesthetics from sediments, enrichment from streambank erosion and developed land runoff. Biomonitoring and habitat assessments indicate moderate levels of enrichment and toxic/urban runoff-type impacts. Vermont Statewide TMDL for Bacteria-Impaired Waters Final Document (pdf 2.3 MB) and Appendix 17- Whetstone Brook (pdf 2.7 MB) identify possible sources of bacterial contamination including: failing or malfunctioning onsite septic systems, leaking sanitary sewer pipes, stormwater runoff from developed areas, and illicit discharges. Nearly 9,000 of Brattleboro's 12,000 residents rely on individual septic systems for wastewater treatment. The report states that: "It has been documented that many of the residential septic systems within the region are pumped too infrequently or not at all, which makes them prone to failure."

A stormwater mapping project has been completed by VDEC and provided to the town documenting the connections between storm drains and discharge points into the Whetstone Brook. Following this study, water testing was conducted under the illicit discharge detection and elimination process to identify specific problem locations. Remediation work is underway and mostly complete. Projects have included repairing sewer line leaks, reconstruction of portions of the storm water drainage system, and repairs to malfunctioning private septic system.

Broad Brook

With most of its 24 square mile watershed in Guilford, Broad Brook also drains a small part of Brattleboro and enters the Connecticut River just over the Vernon line. The Aquatic Life Support rating is *Excellent*, but sediment has been noted as water quality problems in some areas along with a lack of riparian vegetation.

Newton Brook

The lower section of Newton Brook, up to the Pond Road crossing, is impaired for Aquatic Life Support due to excessive nutrients. It is also stressed by sedimentation, temperature and physical habitat alteration due to the loss of riparian vegetation, cows in and crossing the stream and an on-stream pond. The macroinvertebrate and fish communities were both rated as *Poor*. Total phosphorus and nitrogen are both

excessively high. Newton Brook is a priority subwatershed for agricultural environmental management assessments and follow-up project implementation.

Lakes & Ponds in the Basin

There are 17 lakes and ponds over 20 acres in size in the Deerfield River watershed and four in this portion of the Connecticut River watershed. Lake and pond water quality and habitat conditions are monitored through numerous study programs including the Spring Phosphorus and Lake Assessment Programs and by the Lay Monitoring Program among others. While many fully support the requirements of the VWQS, many other lakes and ponds are impacted by acidification, and several lakes and ponds exhibit high levels of fish mercury. Both of these issues result from atmospheric deposition of pollutants from sources outside of Vermont.

This lake-specific information is compiled to create the Vermont Lake Score Card, which has been developed to convey a large amount of data gathered and analyzed through these monitoring efforts. The Score Card rates Vermont lakes in terms of water quality, invasive species, atmospheric deposition, and shoreland condition. Table 3 provides an assessment of individual lakes from the Vermont Lakes Scorecard.

Table 3. Summary of individual lake conditions from the Vermont Lakes Scorecard.

Lakes Score Card

	= Good Conditions
	= Fair Conditions
	= Reduced Conditions
	= Unassessed

Deerfield River	Town	Shoreland	Invasives	Atmospheric	Water Quality
Adams Reservoir	Woodford				
Deer Park Pond	Halifax				
Grout Pond	Stratton				
Harriman Reservoir	Wilmington, Whitingham				
Haystack Pond	Wilmington				
Howe Pond	Readsboro				
Lake Clara	Whitingham				
Lake Raponda	Wilmington				
North Pond	Whitingham				
Sadawga Lake	Whitingham				
Somerset Reservoir	Stratton, Somerset				
South Pond	Marlboro				
Stamford Pond	Stamford				
East Branch North River					
Gates Pond	Whitingham				
Jacksonville Pond	Whitingham				
Laurel Pond	Whitingham				
Shippee Pond	Whitingham				
Connecticut River Direct					
Keets Brook					
Sweet Pond	Guilford				
Weatherhead Hollow Pond	Guilford				
Newton Brook					
Lily Pond	Vernon				
Whetstone Brook					
Hidden Lake	Marlboro				
Pleasant Valley Reservoir	Brattleboro				

Acid deposition is rain, snow, fog or dust that is polluted by acid in the atmosphere and damages aquatic and terrestrial systems. Two common air pollutants acidify the water or dust particles: sulphur dioxide (SO2) and nitrogen oxide (NOX). When these substances are released into the atmosphere, they can be carried over long distances by prevailing winds before returning to earth as acidic rain, snow, fog or dust. When the environment cannot neutralize the acid being deposited, damage occurs. One of the

most apparent features in the natural environment affected by acid precipitation is lakes and ponds. Due to weather patterns and topography two-thirds of the acid impaired lakes are in southern Vermont. Fourteen are in this Basin.

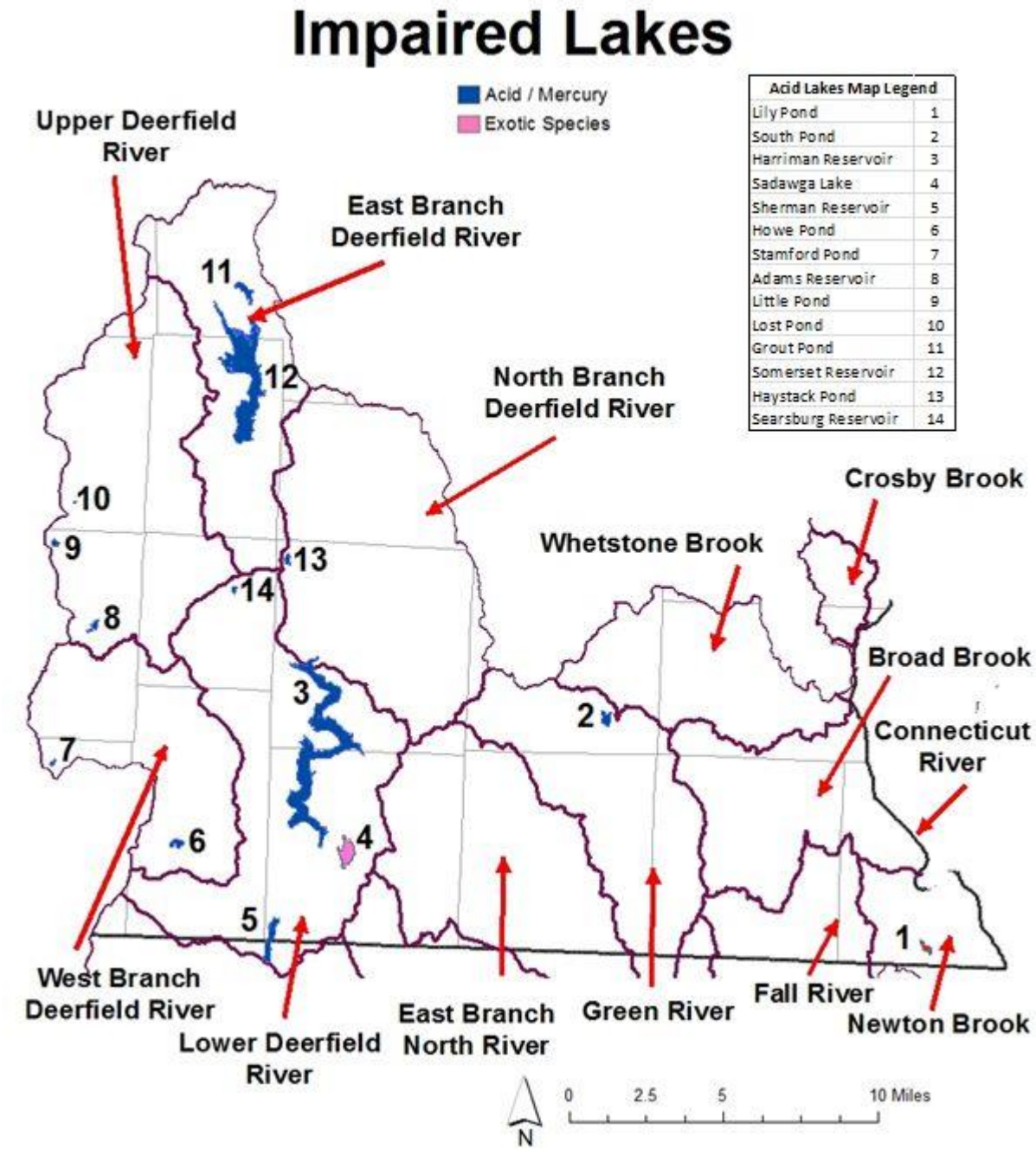


Figure 6. *Map of acid impaired lakes in the Deerfield and adjacent Connecticut River Basin.*

An additional method of evaluating surface waters is to look at their adjacent lands and the impacts these land uses have on water quality. The Windham Regional Commission undertook this analysis, presented in *Undeveloped Waters in Southeastern Vermont* and accompanying Maps, to identify undeveloped surface waters in the region to "help aid in the preservation of these riparian and lacustrine buffer areas in order to support maintaining water quality, habitat values, and societal benefits."

The results reveal that the eastern half of the basin is largely developed along river and stream corridors while much of the western half is protected by the Green Mountain National Forest and large holding of TransCanada Hydro Northeast Inc. with easement restrictions . There are no undeveloped second order and higher stream segments of over 1.5 miles long in central and eastern portions of the study area. While in the GMNF there are several.

Table 4. Second order and higher stream with undeveloped segments over 1.5 miles.

Redfield Brook/Rake Branch	*7.1 mi.*
Deerfield River headwaters	*4.1 mi.*
Deer Cabin Brook	*3.4 mi.*
Yaw Pond Brook	*3.3 mi.*
East Branch Deerfield headwaters	*2.6 mi.*
Glastenbury River	*2.5 mi.*
Vose Brook	*2.5 mi.*

The report encourages its usefulness reflecting that: "Given the important values of undeveloped buffers and the dwindling extent of them, it is important for stakeholders to work to protect those that remain. The information in this report is useful to municipalities, landowners, and conservation groups to inform planning for protecting the resources, and development and implementation of strong regulatory protective measures."

Table 5. Conservation status of lakes and ponds with undeveloped shorelines.

Waterbody	*Percent Undeveloped*	*Percent Conserved*	*Town*
Stamford Pond	*100*	*100*	*Stamford*
Little Pond	*100*	*100*	*Woodford*
Atherton Meadow	*100*	*100*	*Whitingham*
Haystack Pond	*100*	*100*	*Wilmington*
Howe Pond	*100*	*100*	*Readsboro*
Somerset Reservoir	*95*	*100*	*Somerset, Stratton*
Grout Pond	*95*	*100*	*Stratton*

Gates Pond	*82*	*0*	*Whitingham*
Shippee Pond	*79*	*0*	*Whitingham*
Shep Meadow	*77*	*100*	*Somerset*
Harriman Reservoir	*76*	*100*	*Wilmington, Whitingham*

3. General Fisheries Assessment

Twenty-seven species of fish have been reported to occur in suitable habitats within Basin 12 (Table 6). Of this number nearly half are classified to be sport fishes providing anglers with recreational fishing opportunities. Fish species diversity is less so in Basin 13 with only 17 species represented and of these only eight are classified as sport fishes. Four species of salmonids occur in Basin 12: rainbow trout, a non-native species introduced to Vermont in the late 1800s; Atlantic salmon, both sea-run and landlocked strains; brown trout, a European species introduced to the state in the late 1800s; brook trout and lake trout, both native to the state. Only brook trout and brown trout have naturally reproducing populations occurring in both basins. Brook trout is the most widely distributed salmonid in both basins typically thriving in cold, high elevation streams. Water temperature is one of the most significant habitat variables determining the distribution and abundance of brook trout. The upper optimal temperature limit for growth and survival is about 60˚F. Brown trout tend to replace brook trout in lower elevation streams where water temperatures tend to be warmer. The upper limit for good brown trout growth and survival is about 66˚F. The upper short-term tolerable water temperature limits for brook and brown trout are 75˚F and 80˚F, respectively. Streams with temperature regimes that exceed these thresholds are unsuitable habitats for these species.

Brook trout are extensively stocked by the Vermont Fish & Wildlife Department (VFWD) into lakes, ponds and reservoirs located in Basins 12 and 13. These include Somerset Reservoir (Somerset/Stratton), Searsburg Reservoir (Searsburg) and Harriman Reservoir (Whitingham/Wilmington), Adams Reservoir (Woodford), Red Mill Pond (Woodford), and Vernon Hatchery Pond (Vernon). Some streams are also stocked where fishing opportunities exist but cannot be maintained on the basis of natural reproduction alone.

Wild, naturally reproducing brown trout populations exist in several streams located in Basins 12 and 13; however, the species is recognized as a competitor with native brook trout and for this reason is not generally stocked into streams within the region. On the other hand brown trout fisheries are prominent sport fishing resources in Harriman, Sherman Reservoir (Whitingham, VT/Rowe, MA), and South Pond (Marlboro).

The presence of rainbow trout, Atlantic salmon and lake trout in the basins is wholly dependent upon stocking hatchery produced fish into particular streams and/or lakes. At the present time there is no evidence that any of these species reproduce naturally within the basins or survive at levels that contribute to population sustainability. Even though wild, naturally reproducing populations of rainbow trout are widely distributed throughout Vermont, such populations are generally lacking in Windham County except for a few small watersheds (typically less than 15 mi2) mostly confined to low elevations within the Connecticut River Valley. Water chemistry has been suggested as a determinant of where rainbow trout populations have established naturally reproducing populations, i.e. the species seemingly has taken to alkaline and fairly hard streams, like many of the small watersheds of the Connecticut River Valley. Large watersheds, such as the Deerfield River, are poorly buffered systems and therefore unsuitable to rainbow trout establishment in the absence of stocking. Waters stocked by the VFWD with catchable-size (≥6 inches total length) rainbow trout include Harriman Reservoir, Lake Raponda (Wilmington) and the Deerfield River (Wilmington/Searsburg), all located in Basin 12; and into South Pond in Basin 13. Massachusetts Division of Fish and Wildlife stocks yearling rainbow trout into Sherman Reservoir (Basin 12) and Green River (Basin 13).

Table 6. Fish species reported to occur in Basin 12 (**D**eerfield River, **G**reen River, **N**orth River watersheds) and Basin 13 (**F**all River, **B**road Brook, **C**rosby Brook, **W**hetstone Brook, **N**ewton Brook watersheds). Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish. Watersheds are identified respectively by first letter in bold type.

Common name	Scientific name	Basin 12	Basin 13
American eel	*Anguilla rostrata*	D,G	F
Common shiner	*Luxilus cornutus*	D,G,N	B
Golden shiner	*Notemigonus crysoleucas*	D,G	C
Mimic shiner	*Notropis volucellus*	D,G	
Blacknose dace	*Rhinichthys atratulus*	D,G,N	F,B,C,W
Longnose dace	*Rhinichthys cataractae*	D,G,N	F,B,C,W
Creek chub	*Semotilus atromaculatus*	D,G,N	F,B,C,W
Fallfish	*Semotilus corporalis*	D,G,N	
Longnose sucker	*Catostomus catostomus*	D	B,W
White sucker	*Catostomus commersoni*	D,G,N	B,W
Brown bullhead	*Ameiurus nebulosus*	D,G,N	F,B
Northern pike	*Esox lucius*		
Chain pickerel	*Esox niger*	D,N	
Rainbow smelt	*Osmerus mordax*	D,G	

Rainbow trout*	*Oncorynchus mykiss*	D,G,N	C
Atlantic salmon*	*Salmo salar*	D,G,N	
Brown trout	*Salmo trutta*	D,G,N	B
Brook trout	*Salvelinus fontinalis*	D,G,N	F,B,C
Lake trout*	*Salvelinus namaycush*	D	
Banded killifish	*Fundulus diaphinus*	G	
Slimy sculpin	*Cottus cognatus*	D,G	F,B,C,W
Rock bass	*Ambloplites rupestris*	D	
Pumpkinseed	*Lepomis gibbosus*	D,N	F
Bluegill	*Lepomis macrochirus*	D,N	F
Smallmouth bass	*Micropterus dolomieui*	D	
Largemouth bass	*Micropterus salmoides*	D,G	F,W
Tessellated darter	*Etheostoma olmstedi*	N	
Yellow perch	*Perca flavescens*	D,N	F

Of Basins 12 and 13 Atlantic salmon occur only in the former and are there exclusively as the result of stocking. Harriman Reservoir is stocked annually with fall yearling landlocked strain salmon. The VFWD management goal for this stocking is that after several years residency in the impoundment, salmon will grow to the minimum harvestable size of 15 inches total length.

Sea-run or anadromous strain salmon have been stocked into Basin 12 streams, namely the East Branch of the North River and the Green River, going back to 19XX as part of the multi-state and federal agency cooperative program to restore anadromous Atlantic salmon to its historic range within the Connecticut River Basin. The Deerfield River and its tributaries historically supported populations of wild anadromous Atlantic salmon. This species spends its adult life in the marine environment of the North Atlantic but returns to freshwater streams to spawn. Juvenile salmon reside in freshwater for typically two years before migrating out to sea to mature. Salmon were extirpated from the Connecticut River Basin in the early 1800s as a result of dam construction, water pollution and overfishing. Since 1967 the states of Connecticut, Massachusetts, New Hampshire and Vermont in cooperation with the U. S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Forest Service (USFS), hydroelectric power companies, and several non-governmental organizations have been engaged in restoration of salmon. However, due to low adult returns over the past four decades, the U. S. Fish and Wildlife Service in 2012 decided to discontinue its participation in the program. This action was followed by the withdrawal of the state fishery agencies from the program. Consequently 2013 was the final year of stocking salmon fry into Connecticut River tributaries including those of the Deerfield River

identified previously. Parr from this and earlier stockings are expected to reside in stocked streams through 2015/2016 before migrating out to the ocean. The future of adult returns is unknown at this time.

Harriman Reservoir is the only water in Basins 12 and 13 that is managed by the VFWD for a lake trout fishery. Lake trout is a species of large deep lakes providing summer refugia of cold, well-oxygenated water. The fishery in Harriman Reservoir is entirely dependent upon annual stocking of yearling fish.

Warmwater sport fisheries within Basins 12 and 13 are essentially restricted to lakes, ponds and reservoirs. Species of recreational interest are largemouth and smallmouth bass, yellow perch, sunfishes, bullhead and pickerel. Waters located in Basins 12 and 13 are listed in Table YY.

4. Summary of impairments and stresses to the Deerfield and adjacent Connecticut River Basins

The Vermont Surface Water Management Strategy lays out the goals and objectives of the Watershed Management Division to address pollutants and stressors that affect the designated uses of Vermont surface waters. The Strategy discusses the 10 major stressors that are managed to protect and improve surface waters. A stressor is defined as a phenomenon with quantifiable damaging effects on surface waters resulting from the delivery of pollutants to a waterbody, or an increased threat to public health and safety. Stressors result from certain activities on the landscape, although occasionally natural factors result in stressors being present. Managing stressors requires the management of associated activities. When landscape activities are appropriately managed, stressors are reduced or eliminated, resulting in the objectives of the Strategy being achieved, and the goals met.

Impairments and stresses to surface waters in this basin (Table 7 & 8, Figure 5) are generally attributed to one of five major categories:

1) Atmospheric deposition of mercury or acid forming precursors resulting in fish mercury contamination, and acidification of surface waters. The majority of surface water impairments in this Basin are due to atmospheric deposition to naturally sensitive surface waters.
2) Sedimentation and stormwater impacts due to poorly managed land development or poorly managed agricultural practices.
3) Flow alterations
4) Bacteria impairments
5) Invasive species

Table 7. Deerfield River Watershed Stream and Lake Segments with Impacts Summary.

Surface waters are organized by stressors as defined in the Vermont Surface Water Management Strategy.

Surface Waters Affected by Acidification and Atmospheric Deposition  				
Stream or lake segment	Mileage & Status	Pollutant	Source	Further information
Upper Deerfield River below the Searsburg dam	3.6 miles ***Impaired*** – Part A list[4]	acid	atmospheric deposition	Critically acidified; chronic acidification
East Branch Deerfield River below Somerset Dam	5.2 miles ***Impaired*** – Part A list	acid	atmospheric deposition	Critically acidified; chronic acidification
Upper Deerfield River below Searsburg dam	4.0 miles ***Impaired*** – Part D list	mercury	atmospheric deposition	Elevated levels of mercury in all fish. Regional TMDL approved on December 20, 2007.
Adams Reservoir (Woodford)	***Impaired*** – Part D list	acid	atmospheric deposition	Episodic acidification. TMDL approved on September 30, 2003
Lost Pond (Glastenbury)	***Impaired*** – Part D list	acid	atmospheric deposition	Chronic acidification TMDL approved on September 20, 2004.
Little Pond (Woodford)	***Impaired*** – Part D list	acid	atmospheric deposition	Chronic acidification. TMDL approved on September 30, 2003.
Searsburg Reservoir	***Impaired*** – Part D list	mercury	atmospheric deposition	Elevated mercury in all fish except brown bull-head. Regional TMDL approved December 20, 2007.
Grout Pond	***Impaired*** – Part D list	acid	atmospheric deposition	Episodic acidification. TMDL approved on September 30, 2003.

[4] PART B. Impaired Surface Waters - No Total Maximum Daily Load Determination Required
PART C. Surface Waters In Need Of Further Assessment
PART D. Surface Waters With Completed And Approved TMDLs
PART E. Surface Waters Altered By Invasive Aquatic Species
PART F. Surface Waters Altered By Flow Regulation
PART G. Surface Waters Altered By Channel Alteration

Surface Waters Affected by Acidification and Atmospheric Deposition  				
Stream or lake segment	Mileage & Status	Pollutant	Source	Further information
Grout Pond	***Impaired*** – Part D list	mercury	atmospheric deposition	Elevated mercury in all fish except brown bull-head. Regional TMDL approved December 20, 2007
Somerset Reservoir	***Impaired*** – Part D list	acid	atmospheric deposition	Episodic acidification. TMDL approved on September 30, 2003.
Somerset Reservoir	***Impaired*** – Part D list	mercury	atmospheric deposition	Elevated mercury in all fish except brown bullhead. Regional TMDL approved on December 20,2007.
East Branch Deerfield River below Somerset Dam	5.2 miles **Impaired** – Part D list	mercury	atmospheric deposition	Elevated mercury in all fish. Regional TMDL approved on December 20,2007
Haystack Pond	***Impaired*** – Part D list	acid	atmospheric deposition	Chronic acidification. TMDL approved on September 30, 2003.
South Pond	***Impaired*** – Part D list	acid	atmospheric deposition	Episodic acidification. TMDL approved on September 30, 2003.
Sherman Reservoir	***Impaired*** – Part D list	mercury	atmospheric deposition	Elevated mercury in all fish except brown bullhead. Regional TMDL approved on December 20, 2007.
Howe Pond	***Impaired*** – Part D list	acid	atmospheric deposition	Episodic acidification. TMDL approved on September 30, 2003.
Stamford Pond	***Impaired*** – Part D list	acid	atmospheric deposition	Episodic acidification. TMDL approved on September 30, 2003.
Harriman Reservoir	***Impaired*** – Part D list	acid	atmospheric deposition	Episodic acidification. TMDL approved on September 20, 2004.
Harriman Reservoir	***Impaired*** – Part D list	mercury	atmospheric deposition	Elevated mercury in all fish except brown bullhead. Regional TMDL approved on December 20, 2007.
South Branch Deerfield River	3.0 miles ***Stressed***	Low alk, low pH	atmospheric deposition	

Surface Waters Affected by Land Development Activities:

Stream or lake segment	Mileage & Status	Pollutant	Source	Further information
North Branch Deerfield- Tannery Brook Road to 0.2 miles above Snow Lake	0.5 miles – ***Impaired*** Part A list	stormwater	runoff from developed land, construction erosion	Ski area related impervious surfaces and changed runoff patterns
Baselodge Trib	0.2 miles ***Stressed*** –	sediment, habitat alt.	land development, stream channel changes	
North Branch Deerfield River, Snow Lake to Tannery Brk Rd	0.6 miles ***Stressed***	habitat alterations, thermal mod.	Snow Lake, parking lot runoff, erosion	
Iron Stream (Trib to Tannery Brook)	0.4 miles – ***Impaired*** Part A list	iron	land development	Macroinvertebrate community poor in 1996 and 2004.
Beaver Brook	2.8 miles ***Stressed***	Sediment, habitat alt	stream channel alt., riparian veg removal	

Surface Waters Affected by Flow Alteration:

Stream or lake segment	Mileage & Status	Pollutant	Source	Further information
North Branch Deerfield River	11.5 miles ***Altered*** – Part F list	water withdrawal	snowmaking	
Trib to North Branch Deerfield River	1.0 miles ***Altered*** – Part F list	water withdrawal	snowmaking	
Lower Deerfield River	3.5 miles ***Altered*** – Part F list	low temperature water	hypolimnetic release from reservoir	FERC license has a condition that this be addressed if affecting aquatic biota

Other Surface Water Impacts 				
Stream or lake segment	Mileage & Status	Pollutant	Source	Further information
North Branch Deerfield River, downstream of West Dover	***Impaired*** – Part D list	E. coli	elevated E. coli	Elevated E. coli in summer months – sources unknown
Sadawga Lake	***Altered*** – Part E list	Eurasian watermilfoil	Invasive species infestation	Moderate Eurasian watermilfoil growth. Confirmed in 2006. No control.
Ellis Brook	5.2 miles ***Stressed*** – Part C list	unknown	unknown	Biomonitoring data indicated decline in aquatic community health

Table 8. Lower Conn River Direct Stream and Lake Segments with Impacts Summary

Stream or lake segment	Mileage & Status	Pollutant	Source	Further information
Crosby Brook, mouth upstream	0.7 miles ***Impaired*** – Part A list	sediment	land development runoff, channelization, loss of floodplain	
Newton Brook, mouth upstream	2.0 miles ***Impaired*** – Part A list	sediment	agricultural activity	
Lily Pond (Vernon)	***Impaired*** – Part A list	acid	atmospheric deposition	
Whetstone Brook, mouth up to covered bridge & park	2.2 miles ***Impaired*** – Part D list	E. coli	unknown – potentially a failed sewer line/septic system	EPA approved a TMDL Sept. 30, 2011
Whetstone Brook, mouth up to covered bridge & park	2.2 miles ***Stressed*** – No list yet	nutrients, enrichment suspect	unknown	Notes from bio assessment explain nutrient vs sediment stress conclusion.
Connecticut River, Westmoreland,	13.1 miles ***Impaired*** by NHDES	acidity	unknown	Source unknown, low priority for TMDL development
Connecticut River, Hinsdale, 7.6 mi.	7.6 miles ***Impaired*** by NHDES	Acidity, aluminum, copper	unknown	Source unknown, low priority for TMDL development

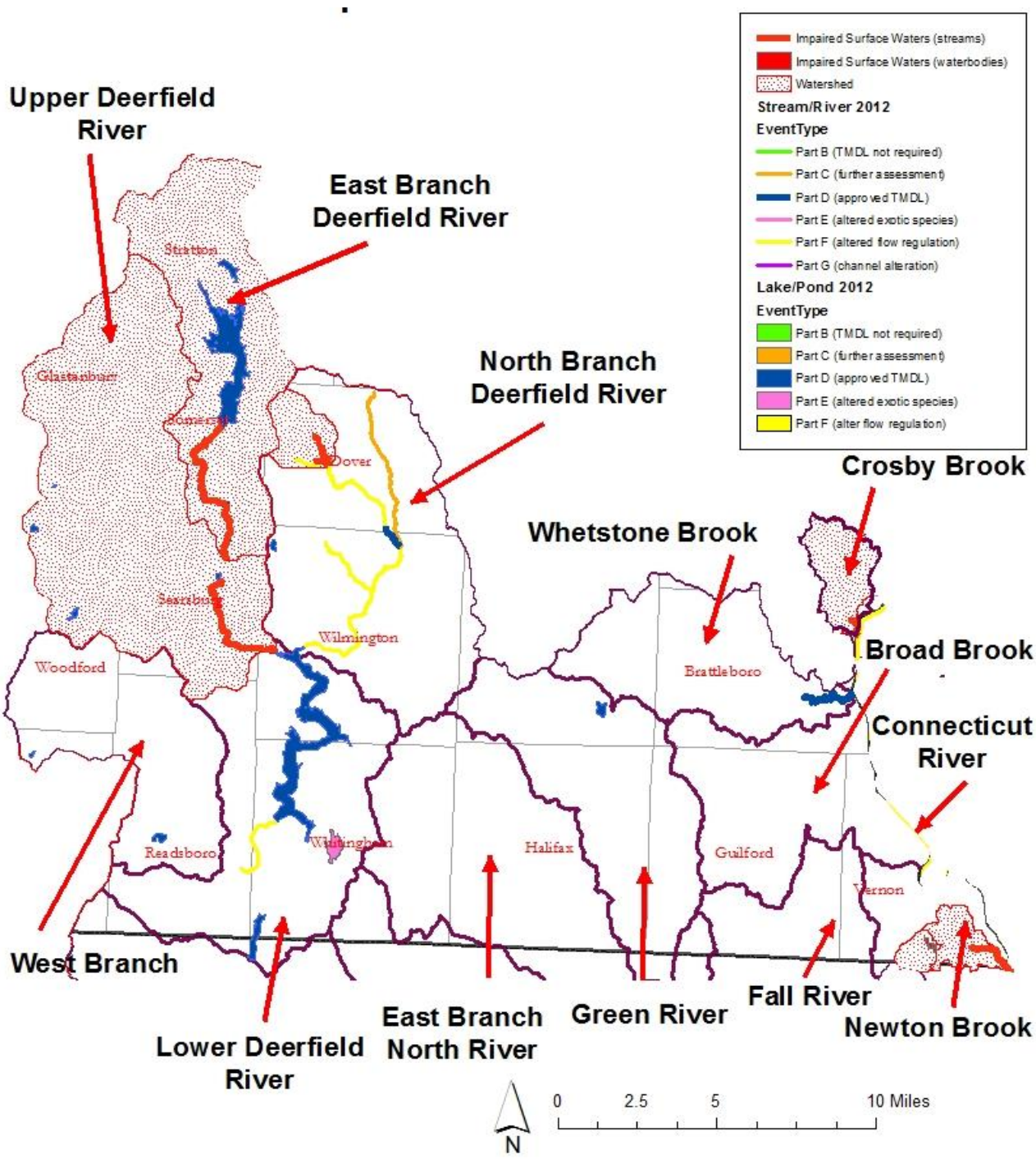


Figure 7. *Map of impaired and stressed waters in the Deerfield and adjacent Connecticut River Basin.*

5. Total Maximum Daily Loads

A TMDL or Total Maximum Daily Load is the calculation of the maximum amount of a pollutant that a waterbody can receive and still meet Vermont Water Quality Standards. In a broader sense, a TMDL is a plan that identifies the pollutant reductions a waterbody needs to meet Vermont's Water Quality Standards and develops a means to implement those reductions. TMDLs can be calculated for correcting water pollution from specific point source discharges or throughout a watershed and balance the location and amount of needed pollution reductions.

Under Section 303(d) of the Federal Clean Water Act, all states are required to develop lists of impaired waters. The list includes impaired lakes, ponds, rivers and streams that do not meet Water Quality Standards. For Vermont, impairment is substantiated by chemical, physical or biological data collected through monitoring and these waters are noted on the state's 303(d) List of Waters. The Federal Clean Water Act requires TMDLs to be developed for waters on the list, the list provides a schedule indicative of TMDL completion priority.

Other waters with completed TMDL or TMDL equivalents are listed in Final State Listings of Waters Outside the Scope of 303d.

TMDLs for Basins 12 – 13 include:

TMDL for 30 Acid Impaired Lakes

TMDL for 4 Acid Impaired Lakes

TOTAL MAXIMUM DAILY LOAD for Waterbodies: 2 Acid Impaired Lakes: VT11-18L03 Lily (Londonderry) and VT13-16L01 Lily (Vernon)

Vermont Statewide Total Maximum Daily Load (TMDL) for Bacteria-Impaired Waters

Appendix 16-No Branch-Deerfield
Appendix 17- Whetstone Brook

Long Island Sound (LIS) Dissolved Oxygen TMDL

Northeast Regional Mercury Total Maximum Daily Load

Stratton Water Quality Remediation Plan

6. Tropical Storm Irene

The summer of 2011 was an exceptionally wet season with higher than normal rainfall resulting in saturated soils and high water levels. On August 28 and 29 Tropical Storm Irene moved through the region following the Connecticut River valley through southern Vermont. Rainfall ranged between 7 and 11 inches through the Deerfield and lower Connecticut River over the two days.

Damage from fluvial erosion and flooding devastated much of the region hitting the Deerfield River and Whetstone Brook particularly hard. The Green River and East Branch of the North River also experienced significant damage.

Previous geomorphic assessment work on the Whetstone Brook led to a Fluvial Erosion Hazard (FEH) zone being mapped for the watershed. Post-flood mapping demonstrates the usefulness of this planning exercise as the predicted areas of erosion hazards were an accurate forecast of actual conditions post-flood.

Determining FEH zones for all waters in the region is strongly recommended. Using this information as a planning tool may reduce the loss of life and property from future severe flood events.

The Windham Regional Commission with funding from VDEC has produced a report and maps of Tropical Storm Irene damage in the region. These maps show the location and extent of damage caused by flooding and fluvial erosion.
www.windhamregional.org

Glen Park on Whetstone Brook - Before and After Tropical Storm Irene

7. Direct discharges to surface waters in the Deerfield River and Lower Connecticut River Basins

Overview

In the Deerfield River and adjacent Connecticut River drainage, six municipal wastewater treatment facilities, one paper manufacturing facility, and the Vermont Yankee nuclear power generation facility are all subject to NPDES discharge permit requirements issued by the State of Vermont (Table 8).

An overarching consideration for the issuance of permits for municipal facilities in the Deerfield River Basin and adjacent Connecticut River is the Long Island Sound TMDL for nitrogen. This multi-state TMDL has been promulgated with interim wasteload and nonpoint source nitrogen load allocations. As of the issuance of this Plan, all facilities are operating under administrative continuance of existing permits while the wasteload allocations are being refined. Specifically, the WSMD is implementing a wasteload allocation plan and permitting strategy in all Connecticut River direct discharges to account for the new nitrogen limitations and to meet an interim total Vermont load of 1,727 lbs. N/day. Under that strategy, permit reauthorizations are proceeding for the most of these facilities in 2013 and 2014, with the exception of Brattleboro.

As part of a necessary refinement of the facility-specific nitrogen wasteload allocations, WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions for nitrogen, which is only recently regulated by the States of Vermont and New Hampshire. Heretofore, nitrogen has not been considered a pollutant of concern for inland freshwaters and has not been addressed by water quality based effluent limitations within wasteload allocations for a TMDL.

With respect to Vermont Yankee, the Department is presently engaged in development of thermal discharge effluent limitations as set forth by §316(a) and §316(b) of the Clean Water Act. These provisions require a comprehensive modeling analysis of the thermal plume from the facility. This analysis will assess the compliance of the plume with provisions of the Vermont (and New Hampshire and Massachusetts) WQS, the likelihood that the plume may impact significant migratory fishes, alternatives analyses for reduction of thermal discharge, and identification of a preferred alternative.

Table 9. Deerfield and Lower Connecticut River Basin Wastewater Treatment Facilities and other Facilities Subject to NPDES Direct Discharge Permits

Facility (permit #)	Permit expiration date	Planned Permit Re-Issuance Date	Design Flow MGD	IWC[1] 7Q10 / LMM	Treatment type	Receiving Water
Brattleboro 3-1242	June 30, 2009	2016	3.0	IWC[1,2] 7Q10 / LMM	Rotating biological contact, clarification, chlorination	Connecticut River
Cold Brook Fire District 1 3-1296	Dec 31, 2008	2014	0.028	0.004 / 0.0014	Hybrid indirect discharge via spray-field with direct discharge.	North Branch, Deerfield River
Readsboro 3-1215	June 30, 2012	2014	0.075	0.040 / 0.005	Aerated lagoons, secondary treatment, chlorination/de-chlorination	Deerfield River
Whitingham 3-1229	June 30, 2010	2013	0.0123	0.004 / 0.002	Aerated tanks, rotating biological contact, clarification, and UV disinfection	Harriman Reservoir
Whitingham – Jacksonville 3-1230	June 30, 2010	2013	0.05	n/a[3]	Aerated tanks, rotating biological contact, clarification, and UV disinfection	East Branch, North River
Wilmington 3-1281	June 30, 2008	2014	0.135	0.404 / 0.076	Rotating biological contact and aerated lagoon, chlorination/de-chlorination	North Branch, Deerfield River
FiberMark North America Inc. 3-1136	June 30, 2017	2022	2.0	0.166 / 0.024	Primary clarification and aerated stabilization	Connecticut River
Entergy VT Yankee 3-1199	March 31, 2006	2014	543 open cycle 12.1 closed cycle	0.003 / 0.0010	Cooling water intake/discharge	Connecticut River

1) Instream Waste Concentration (IWC) – or the proportion of river flow at lowest base (7Q10) and low median monthly (LMM) flow attributable to discharge, for the facility design flow. Note that the IWC is specific to the flow of receiving water.
2) IWC values for all facilities have been updated to reflect all available hydrologic data through October, 2012.

3) Facility discharges to a reservoir. Dilution statistics for stream not applicable.
4) The authorization for Entergy VT Yankee is solely for thermal discharge. Allowable discharge varies by season and cycling.

Groundwater is classified under a separate system. Groundwater under the 66.5 acre Windham Solid Waste District landfill in Brattleboro, has a Classification of IV – Contaminated - Not suitable as a source of potable water but suitable for some agricultural, industrial and commercial use.

Facility-specific information

Brattleboro

The Town of Brattleboro is completing up a major (~$30 million) plant refurbishment and upgrade. To address nitrogen, the upgrade includes an MBBR (moving bed biofilm reactor) treatment stage, ahead of upgraded rotating biologic contact chambers. The MBBR stage is intended to increase the organic treatment capacity of the plant, when it is operated aerobically, in front of the upgraded RBC's with expanded organic capacity. The overall plant upgrade substantially increases the organic treatment capacity of the plant, although not the hydraulic (flow) capacity. Hydraulically, the plant is operating well below permitted flow capacity, but the Town of Brattleboro wished to have substantial reserve organic treatment capacity to accommodate future food and beverage industries. When the MBBR stage is operated anoxically, it can lower total nitrogen, but it is not specifically intended to achieve extremely low total nitrogen concentrations. A space on the plant site has been reserved for future facilities for additional total nitrogen removal, if required.

Photo courtesy of Brattleboro DPW

Cold Brook FD 1

The Cold Brook facility consists of a pair of indirect sprayfield discharges, with any overflow directed to a permitted direct discharge to a waste management zone on the North Branch. As of the issuance of the prior permit, there had been no occurrences of direct discharge. Coincident with the development of the Hermitage Ski Area, the Cold Brook facility is proposing to expand discharge from 28,000 GPD to 100,000 GPD. The

Cold Brook facility is undergoing engineering evaluation to determine necessary infrastructure to accommodate the proposed change. Coincident with NPDES permitting, the increased flows will be evaluated for their reasonable potential to cause or contribute to a water quality impairment.

Wilmington

The Wilmington facility is identified as a high priority in the Clean Water Statewide Revolving Fund for refurbishment. Though not a permit requirement, the Town initiated its own 20 year evaluation in 2012. The report was completed in March 2013 and included an initial evaluation of alternatives for upgrade of the primary treatment. This report included recommended repairs and maintenance, and the next step was to begin the preliminary engineering in early 2014. The State Priority List identifies ~$1.6M in anticipated loan need for 2014.

FiberMark North America Inc.

The wastewater treatment system consists of primary clarification followed by an 8.3 million gallon aerated stabilization basin. The treated effluent is discharged via a diffuser into the Connecticut River. Primary clarifier sludge was previously dewatered on a vacuum filter and screw press. In 1999, hydraulic curtains (floating baffles extending to and anchored to the lagoon floor) were installed in the treatment lagoon in order to provide 'staged' treatment and to minimize the potential for short-circuiting. Also at that time, a new screw press for sludge dewatering was installed in series after the existing vacuum filter. In 2007, an Aris-Andritz belt press for sludge dewatering was installed replacing the existing vacuum filter/screw press combination sludge processor. The most recent reasonable potential review for FiberMark's current authorization to discharge established a more restrictive effluent limitation for turbidity, based upon a review of facility monitoring data.

Entergy- Vermont Yankee

The Vermont Yankee Nuclear Power Station (ENVY) is located on the west shore of Vernon Pool, an impoundment of the Connecticut River created by the Vernon Dam. The facility, which began operation in 1972, is classified as a Boiling Water Reactor with a rated core thermal power level of 1593 megawatts (MW), providing a gross electrical output of 537 MW. The remainder of the energy, 1056 MW, is removed as heat by the circulating water system as it passes by the condenser and discharges to the Connecticut River, or to the atmosphere via mechanical draft cooling towers. The facility is required to limit increases in Connecticut River water temperature to within specified ranges identified in the permit. The temperature conditions are contingent upon time of year and ambient river temperature. During open-cycle cooling, the

facility is permitted to withdraw then discharge 543 million gallons per day (MGD) or 840 cfs. At closed cycle cooling, the facility is permitted to discharge 12.1 MGD or 18.7 cfs.

The Department is in the process of conducting a comprehensive re-evaluation of permit conditions associated with the facilities thermal discharge and cooling water intake as specified respectively by §316a and §316b of the Clean Water Act. The §316a provision requires that the thermal discharges do not unduly elevate receiving water temperatures beyond criteria limits established by VT Water Quality Standards. The §316b provision requires that the cooling water intake structure does not unduly impact aquatic life uses of the Connecticut River as a result of entrainment and impingement of larval fish. The Department is working with ENVY and independent experts to conduct these analyses, which are necessary to inform final permit conditions. Simultaneously, Entergy, Inc. has indicated the intention to close ENVY as of Dec 31, 2014. The Department is presently evaluating the ramifications of closure of ENVY with respect to discharge permitting and other aspects of the facility decommissioning that may impact the Connecticut River.

8. Other Industrial Surface Water Withdrawal and Use

In addition to ENVY, there are other industrial users in the Basin that withdraw from surface waters. Snow-making operations including Mount Snow and the Haystack/ Hermitage resorts seasonally withdraw 5.8 mgd, irrigation and animal watering uses withdraw 2.9 mgd, and other industrial uses add up to another 4.8 mgd. TransCanada, Inc. operates three hydroelectric generation facilities on the mainstem of the Connecticut River, the operating license for which is presently undergoing renewal.

Chapter 3. Management Goals for Surface Waters in the Basin

The protection or improvement of water quality and water-related uses can be promoted by establishing specific management goals for particular bodies or stretches of water. The management goals describe the values and uses of the surface water that are to be protected or achieved through appropriate management. In Chapter 2 of this plan, a number of waters were identified as being of notable high quality, and these, as well as other unique areas, may be candidates for establishing alternate management goals or augmented protections through one of the processes that are further described below.

- Identification of existing uses
- Opportunities for designation of Outstanding Resource Waters.
- Opportunities for reclassification of waters.
- Reclassification of wetlands
- Designation of waters as warm and cold water fisheries.

The Agency of Natural Resources is responsible for determining the presence of existing uses on a case by case basis or through basin planning, and is also responsible for classification or other designations. Once the Agency establishes a management goal, the Agency manages state lands and issues permits to achieve all management goals established for the associated surface water. Before the Agency recommends management goals through a classification or designation action, input from the public on any proposal is required and considered. The public may present a proposal for establishing management goals for Agency consideration at any time. When the public develops proposals regarding management goals, the increased community awareness can lead to protection of uses and values by municipalities and individuals.

Public involvement is an essential component to restoring and protecting river and lake ecology. The Vermont Water Quality Standards state "Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest." Emphasis on the identification of values and expectations for future water quality conditions can only be achieved through public contributions to the planning process.

Since the 1960s, Vermont has had a classification system for waters that establishes management goals. Setting water quality management goals was the responsibility of the Vermont Water Resources Panel until these responsibilities were transferred to the Agency of Natural Resources in 2013 year through Act 138. These goals describe the values and uses of surface waters that are to be protected or restored through

appropriate management practices. The Agency works to implement activities that restore, maintain or protect the management goals. The current classification system includes three classes: A(1), A(2), and B.

1. Class A(1), A(2) and B Waters

Presently in all basins across Vermont, waters above 2,500 feet in elevation are classified A(1) by Vermont statute. In the Deerfield and adjacent Connecticut River Basin, Cold Brook is the only other designated A(1) waterbody, covering from 2,500 feet of elevation to its confluence with Mountain Brook, near Dover. The management objective for A(1) waters is to maintain their natural condition. DEC has documented certain streams that have the existing level of water quality that merit A(1) designation. These are listed in Table 10. VDEC recognizes and supports the United States Forest Service's consideration that all Class B surface waters occurring in designated wilderness areas below 2,500 ft. be reclassified to A(1). Insofar as designated wilderness areas are off-limits to all forms of development and mechanized activity of any kind, a management goal of "waters in their natural condition" is appropriate and supportable. The Department has also identified the Black Brook subwatershed, and Grout and Stamford Ponds for consideration as a candidate A(1) surface waters.

Table 10. Candidate surface waters for reclassification to Class A(1).

Water	Location	Supporting Data
East Branch Deerfield and tributaries, above Somerset Reservoir	Stratton, Sunderland	Excellent macroinvertebrates, water chemistry, GMNF and TransCanada protected lands
West Branch Deerfield and tributaries	Readsboro, Woodford, Stamford	Excellent ecological integrity evidenced by macroinvertebrate assessments
Deerfield River and tributaries above confluence with East Branch	Somerset, Glastenbury, Sunderland	Excellent macroinvertebrates on Deerfield River
North Branch Deerfield and tributaries, 0.6 mi. upstream of	Dover	Excellent ecological integrity evidenced by macroinvertebrate

Water	Location	Supporting Data
Snow Lake		assessments
Green River & tributaries	Marlboro, Halifax, Guilford	Excellent ecological integrity evidenced by macroinvertebrate assessments
All waters in GMNF Wilderness Areas below 2500 feet	Lye Brook Wilderness, George D. Aiken Wilderness, Glastenbury Wilderness	Federally-designated National Wilderness Area
East Branch North River – above the Jacksonville WWTF	Halifax, Whitingham	Excellent macroinvertebrates
Grout Pond	Stratton	
Mud Pond	Stamford	
Stamford Pond	Stamford	

Surface waters used as public water supplies are classified A(2). The only class A(2) waters in this Basin are Haystack Pond, Howe Pond and the tributary Howe Pond Brook, and Pleasant Valley Reservoir in Brattleboro.

2. Surface waters exhibiting very high quality biological integrity or fisheries

Tactical Basin Plans identify surface waters where monitoring data indicates conditions are significantly better than the water quality goals and objectives of the Water Quality Standards. This high-level of quality may be protected by site-specific application of the antidegradation policy of the Standards, or by reclassification. Data analysis of water quality and ecological integrity indicates that several waters in the Basin support very high quality conditions (Table 11). A similar analysis of lakes and ponds ranks lakes using long-term datasets for water quality, biological diversity and unusual or scenic natural features. Scores from these separate categories are combined to identify lakes with exemplary qualities in all three, of which there are four in the Deerfield and adjacent Connecticut River Basin.

Table 11. Surface waters in the Deerfield and adjacent Connecticut River Basin exhibiting Very High Quality status.

Water	Location	Supporting Data
Ellis Brook mainstem	Wilmington, Dover	Excellent macroinvertebrates
Rose Brook, trib. to Binney Brook	Wilmington	Very Good biological condition, high abundance, richness and EPT.
East Branch North River – above the Jacksonville WWTF	Halifax, Whitingham	Excellent macroinvertebrates
Crosby Brook South Branch, above I-91	Brattleboro, Dummerston	Very Good macroinvertebrates
Crosby Brook, above I-91	Brattleboro, Dummerston	Excellent - Very Good macroinvertebrates
Whetstone Brook, above Stark Rd.	Brattleboro, Marlboro	Very Good macroinvertebrates
Central Park Brook (42.755135, -72.517694)	Vernon	Good macroinvertebrates, Excellent fish
All waters recommended for A(1) reclassification		See Table 10.

The Vermont Fish & Wildlife Department assesses wild trout populations and important nursery areas to document very high quality recreational fisheries, which are typically found in surface waters that exhibit clean and cool conditions.

Abundant wild trout populations are defined as supporting multiple age classes of one or more species of wild trout (brook, brown and/or rainbow trout) at levels generally equal to or greater than 1,000 fish per stream-mile and/or 20 pounds per acre. It should be recognized that wild trout populations vary widely from year to year and therefore an individual population may sometimes go below or greatly exceed these values in a given year. Other waters that have not been surveyed may also support similar wild trout densities and may be identified as Very High Quality Waters (VHQW) in the future.

Due to natural habitat limitations as well as impairments resulting from anthropogenic alterations of Basins 12 and 13, all streams, with one exception, match or exceed the density threshold defining VHQW. The exception is the so-called Harriman Bypass located downstream of Harriman Reservoir on the Deerfield River.

Harriman Reservoir is a fishery of regional importance especially to anglers residing in southern Vermont and non-resident anglers from Massachusetts and Connecticut. Its significance is due in large part to the diverse fishing opportunities it satisfies that otherwise require traveling to other waters located further north. Ice fishing for yellow perch, trout and salmon, and rainbow smelt in particular generates considerable fishing pressure.

Other recreational sport fishing resources of regional note include open-water angling for smallmouth bass in Harriman Reservoir and largemouth bass in Sadawga Lake. South Pond (Marlboro) produces large brown trout. Additionally, South Pond is unique for a southern Vermont lake of its size (75 acres) in that it supports a self-sustaining population of rainbow smelt, an important forage fish for salmonids. The only other waters supporting smelt populations within the region are Harriman and Sherman reservoirs.

Table 12. Warmwater fisheries existing in Basins 12 and 13 lakes, ponds and reservoirs.

Water body	Species*						
	LMB	SMB	YLP	NRP	CHP	BRB	SUN
Grout Pond (Basin 12)		X	X		X	X	X
Harriman Reservoir (Basin 12)		X	X		X	X	X
Howe Pond (Basin 12)			X		X	X	X
Lily Pond (Basin 13)	X		X	X	X	X	X
Lake Raponda (Basin 12)		X	X		X	X	X
Sadawga Pond (Basin 12)	X		X		X	X	X
Sherman Reservoir (Basin 12)		X	X		X	X	X
Somerset Reservoir (Basin 12		X	X		X	X	X
Weatherhead Hollow Pond (Basin 13)	X		X		X	X	X

*Largemouth bass, LMB; smallmouth bass, SMB; yellow perch, YLP; northern pike, NRP; chain pickerel, CHP; brown bullhead, BRB; sunfish (bluegill, pumpkinseed and/or rock bass), SUN.

3. Existing Uses

There are many identified special uses, features, and values of the Deerfield River and adjacent Connecticut River, and its numerous tributaries including waterfalls, cascades, whitewater boating stretches, and swimming holes. All surface waters in Vermont are managed to support designated uses valued by the public including swimming, boating, and fishing. The degree of protection afforded to these uses is based on the water's class as described above. In certain surface waters, however, the existence of

uses is protected absolutely if the Agency of Natural Resources identifies them as existing uses under the anti-degradation policy of the Vermont Water Quality Standards. Specifically, this means that an existing use may not be eliminated by the issuance of a permit or other action where compliance with the Water Quality Standards is assessed (DEC Anti-degradation Procedure, 2012). The Agency identifies existing uses of particular waters either during the basin planning process or on a case-by-case basis during application reviews for state or federal permits. During the development of this tactical basin plan, DEC has identified:

- The existing use of the waters for swimming;
- The existing use of waters for boating;
- The existing use of waters for public water supply;
- The existing use of the water for water supply; and,
- The existing use of water for recreational fishing,
- The existing use for aquatic life support (aquatic biota and habitat).

It is DEC's long-standing stipulation that all lakes and ponds in the basin have existing uses of swimming, boating and fishing. During the planning process, DEC has collected sufficient information to identify the existing uses listed in Appendix A for rivers and streams. The list is not meant to be exhaustive. The public is encouraged to nominate other existing uses, which may be included in the basin plan or catalogued for a more thorough investigation when an application is submitted for an activity that might adversely affect the use.

4. Outstanding Resource Waters (ORW)

In 1987, the Vermont Legislature passed Act 67, "An Act Relating to Establishing a Comprehensive State Rivers Policy." A part of Act 67 provides protection to rivers and streams that have "exceptional natural, cultural, recreational or scenic values" through the designation of Outstanding Resource Waters (ORW). Depending on the values for which designation is sought, ORW designation may protect exceptional waters through the permits for stream alteration, dams, wastewater discharges, aquatic nuisance controls, solid waste disposal, Act 250 projects and other activities. ORW are waters which can be designated by the Agency of Natural Resources through a petition process. ORWs display outstanding qualities that are determined to deserve a higher level of protection. ORW designation may be based on any one or more of the following features:

1. existing water quality and current water quality classification;

2. the presence of aquifer protection areas;
3. the waters' value in providing temporary water storage for flood water and storm runoff;
4. the waters' value as fish habitat;
5. the waters' value in providing or maintaining habitat for threatened or endangered plants or animals;
6. the waters' value in providing habitat for wildlife, including stopover habitat for migratory birds;
7. the presence of gorges, rapids, waterfalls, or other significant geologic features;
8. the presence of scenic areas and sites;
9. the presence of rare and irreplaceable natural areas;
10. the presence of known archeological sites;
11. the presence of historic resources, including those designated as historic districts or structures;
12. existing usage and accessibility of the waters for recreational, educational, and research purposes and for other public uses;
13. studies, inventories and plans prepared by local, regional, statewide, national, or international groups or agencies, that indicate the waters in question merit protection as outstanding resource waters; and
14. existing alterations, diversions or impoundments by permit holders under state or federal law.

While there are presently no ORWs in Basin 12-13, several surface waters have been identified as prospective candidates for ORW, which are presented in Table 13. As part of the implementation of this tactical basin plan, the Department will evaluate the consistency of these surface waters with the features and values identified in prior ORW determinations. Surface waters that satisfy criteria for designation as ORW will be proposed for such designation through rulemaking.

Table 13. Surface waters identified as prospective Outstanding Resource Waters

Water	Location	Supporting Data	ORW Feature
Grout Pond	Stratton	WQ, scenic, RTE, Uncommon plant & animal	1, 5, 6, 8, 12
Howe Pond	Readsboro	Class A2, state forest land	1, 2, 5, 6, 8,
Lake Raponda	Wilmington	RTE, Uncommon plant	1, 5, 6, 8, 12

Lily Pond	Vernon	RTE, NC, uncommon plant & animal	5, 6, 8, 12
Halifax Gorge	Halifax	1,500 ft spanning gorge, East Branch North River	7, 8, 12

5. Other High Quality Waters

Many of the Deerfield and adjacent Connecticut River Basin's rivers and streams, lakes and ponds, and wetlands currently achieve a very high quality of water and aquatic habitat and are exceptional places to swim, fish, boat, and otherwise enjoy. Some of these are identified in Chapter 2 (above). In addition to protecting and improving water resources by managing stressors, there is the opportunity to protect surface waters by identifying and documenting the excellent quality and preserving those excellent conditions or features through various classifications or designations. Several statewide references and reports available to the exceptional ecological quality or recreational uses of Vermont surface waters. A major new resource, the Agency's BioFinder, provides a statewide application identifying surface water and riparian areas with a high contribution to biodiversity.

6. Class 1 Wetland Designation

It is policy of the State of Vermont to identify and protect significant wetlands and the values and functions they serve in such a manner that the goal of no net loss of such wetlands and their functions is achieved. Based on an evaluation of the extent to which a wetland provides functions and values it is classified at one of three levels:

Class I: Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore, merits the highest level of protection

Class II: Merits protection, either taken alone or in conjunction with other wetlands

Class III: Neither a Class I or Class II wetland

There are currently no Class 1 wetlands in Basin 12-13. However, as part of the development of this tactical basin plan, several surface waters have been identified as wetlands to study for Class 1 potential, which are presented below. As part of the implementation of this tactical basin plan, the Department will develop and implement procedures and documents to enable submission, evaluation, and implementation of petitions to classify wetlands as Class 1 (or to downgrade Class 1 to Class II) wetlands.

Table 14. Wetlands proposed for study to determine their potential for Class 1 reclassification:

Vernon, black gum swamps
Somerset/Stratton, Deerfield River riparian wetland complex
Somerset/Stratton, wetland complex east of Somerset Reservoir
Somerset, Grout Pond wetland complex
Whitingham, Atherton Meadows
Whitingham, floating bog in Sadawga Pond.

Chapter 4 - Watershed Improvement Actions and the Implementation Table

The heart of tactical basin planning is the implementation of targeted actions that work toward water quality protection and improvement. Actions are chosen that: address the ten stressors identified in the Statewide Management Strategy; have clear goals and objectives; and list tasks and benchmarks to track progress. Types of projects include assessment, monitoring, protection, restoration and planning. Each is laid out in the Implementation Table indicating the project objective, the actions required, the potential partners and funding sources and the focus area for the project.

1. Watershed Projects Completed by ANR and/or Partners during the Planning Process

Tactical planning is an on-going, iterative process. Throughout this planning endeavor projects have been and are being implemented. Table 15 provides a sampling of these projects.

Table 15. Watershed Projects Completed (C) or In-Progress (P)

Project	Purpose	Partners
Deerfield River Watershed		
North Branch SGA - C	SGA updated to create Corridor Plan and develop FEH	WRC, DREF, Bear Creek Environmental
Wilmington buffer planting and berm cuts - C	improve floodplain access, prevent downtown flooding	WCNRCD Trees for Streams, Town
Post-Irene sites review of Wilmington - C	review proposed projects for both flood resiliency and recreational trail development	Town
Flood Mitigation and Floodplain Design - Fluvial Erosion Hazards workshop - C	education for regional and municipal officials	FEMA, WRC
Undeveloped stream and lake shoreline & Irene damage mapping - C	basin planning information, prioritize areas for protection	WRC
school-based water quality monitoring program - P	elementary school education	Southern VT Natural History Museum, DREF
Macroinvertebrate sampling on VT reaches - P	volunteer monitoring program providing data for ALUS assessment	DRWA, DREF
Green River SGA - P	baseline data, create Corridor Plan and develop FEH	WRC, Fitzgerald Environmental

Connecticut River Watershed		
TransCanada FERC relicensing process for Wilder, Bellows Falls, Vernon and Turners Falls dams, studies of impacts to CT River – P	Develop conditions for future operation of these hydroelectric projects that will reduce or mitigate their impacts. Submit study requests on impacts of dam operations on the status and habitat conditions of fish, mussels, dragonflies, Fowler's toads, tiger beetles and sediment transport	USFWS, USFS, NHFG, TNC, CRWC, many others
CT River WQ monitoring - P	begin first volunteer CTR monitoring sites	Putney Rowing Club, SeVWA, CRWC
Participate in CRJC Wantastiquet LRS and permit review - P	review for impacts to CT River	
Putney Paper wastewater discharge permit renewal review - P	permit renewal	

Crosby Brook

SGA, RCP and FEH - C	baseline data, create Corridor Plan and develop river corridor	WCNRCD, Fitzgerald Environmental (consultant)
Floodplain project - C	floodplain restoration and buffer	WCNRCD, VYCC
Mobil, Motel 6 and car lot - C	buffer plantings	WCNRCD, VYCC
Head-cut stabilization - C	gully erosion remediation	WCNRCD, AOT, VYCC
Black Mountain Road - P	slope failure stabilizations and buffer plantings	WCNRCD, VYCC
Stormwater mapping and IDDE study - C Putney Road stormwater planning - C	system mapping, IDDE study, project prioritization stormwater study	Town of Brattleboro AOT, Town

Whetstone Brook

SGA and RCP, FEH map developed - C	baseline data, create Corridor Plan and develop river corridor	WCNRCD, Landslide Inc.
Purchase of Locke Field (behind Chelsea Royale Diner) - C	floodplain protection	WCNRCD, VRC, West Brattleboro Association, Westgate Housing Trust
Bacteria TMDL development - C	water quality improvement	

Brattleboro stormwater mapping and IDDE study - C	identify illegal discharges into stormwater system, fixes to leaking water supply lines and leaking wastewater lines	Town of Brattleboro, Stone Environmental (consultant)
Farmers Market – Malloy parking lot - C	buffer planting, pervious pavement and invasives control	Brattleboro Farmers Market, WCNRCD
LaRosa Program volunteer WQ monitoring - P	volunteer monitoring program providing data for WQ assessment	SeVWA, CRWC
Glen Park and Tri-Park - C	buffer plantings	WCNRCD
All Soul's Church – driveway stabilization & raingarden - C	stabilization & raingarden for stormwater runoff control	All Soul's Church

As of this writing, over $465,000 has been invested in water quality projects in the Connecticut River watersheds and over $53,000 in the Deerfield River watershed.

2. About Flood Resiliency

The Vermont Legislature passed Act 16, which takes effect in July 2014. The Act requires municipal and regional plans to incorporate a "flood resilience" component into all future plans. Working towards resiliency means both proactively reducing vulnerabilities to flooding and flood damage, and improving response and recovery efforts when flood events do occur, so that communities bounce back quickly and minimize long term economic, social, and natural resource impacts. The effort will include creating maps to identify local flood hazard areas, identifying specific areas that should be protected for their values of slowing down or attenuating floodwaters (including floodplains, river corridors, forests and wetlands) and recommending specific strategies and policies that will help protect these areas and reduce the risks facing existing development. ANR will provide resources and assistance to make flood resiliency an integral part of town planning including river corridor maps and model language for town plans. Numerous Tactical Basin Plan Actions will assist communities in becoming more flood resilient.

3. Tactical Plan Implementation Table

Assessment and Monitoring Projects

Objective 1: Complete on-the-ground shoreline assessments of the lakes and ponds in the Basin.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Reference WRC shoreline maps	WRC	N/A	
2) Assess and ground-truth	WRC, VDEC	ANR	All un-assessed lakes

Objective 2: Monitor and assess the temperature issues created by the cold water discharges from Somerset, Searsburg and Harriman dams and warm lake water in the reservoirs.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Monitor above and below each discharge & reservoir	USFS	USFS, ANR	Deerfield River & East Branch Deerfield
2) Assess fisheries above and below each discharge & reservoir	USFS	USFS, ANR/VDEC & VFWD	Deerfield River & East Branch Deerfield

Objective 3: Monitor waterbodies with no or little data.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Monitor	VDEC – Lakes & Ponds	ANR	Binney Brook
			Beaver Brook
			Black Brook
			Blue Brook
			So. Branch Deerfield
			Ellis Brook
	VDEC - WSMD		Fall River
			Keets Brook
			Connecticut River

Objective 4: Monitor and assess Ellis Brook to determine cause of degradation to ALS and fisheries as listed in 303(d) Part C – Waters in Need of Further Assessment.			
Action	Partners	Potential Funding Sources	Implementation Location
Biomonitoring & chemical assessment	VDEC – BASS lab	ANR	Ellis Brook Stations 0.5 –> 2.6

Objective 5: Monitor, assess and implement clean-up of tritium contamination in the Connecticut River as Listed in Part C.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Monitor tritium levels in groundwater discharges to the CT River and in the river itself	Entergy-VT Yankee, VDOH, VDEC	private	CT River, Vernon
2) Remove and mitigate tritium contamination	Entergy-VT Yankee	private	

Objective 6: Monitor the impacts of the Deerfield Wind Projects on the surrounding Class A waters to ensure there is no future degradation of water quality.			
Action	Partners	Potential Funding Sources	Implementation Location
Biomonitoring & chemical assessment	VDEC – BASS lab	Deerfield Wind, LLC ANR	All surrounding Class A brooks

Objective 7: Survey, assess and document biodiversity in areas of the Basin with insufficient data to reference in BioFinder.			
Action	Partners	Potential Funding Sources	Implementation Location
Conduct surveys	VDFW, conservation commissions	ANR	Wilmington, Whitingham, Halifax, Brattleboro, Guilford

Objective 8: Conduct geomorphic assessment & corridor planning on the East Branch of the North River.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Conduct SGA	WCNRCD, WRC, DRWA	ERP, DREF	Mainstem, Branch Brook, Gates Pond Brook
2) Compile corridor plan			

Objective 9: Expand volunteer monitoring on the major lakes in the Basin.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Lay lake monitoring program	VDEC – Lakes & Ponds, watershed associations	ANR, WG	Gates, Grout, Harriman, Howe, Jacksonville, Lily, Sadawga, Searsburg, Sherman, Shippee, Somerset, Weatherhead Hollow
2) VIP monitoring program		ANR, WG, ANS Grant-in Aid	Gates, Grout, Harriman, Howe, Jacksonville, Lily, Raponda, Sadawga, Searsburg, Sherman, Shippee, Somerset, Weatherhead Hollow Grant-in Aid

Objective 10: Locate, field-verify and document vernal pools in the Basin to fully protect wetlands.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Continue project funding for & mapping of vernal pools	conservation commissions, watershed associations VCE, Arrowwood Env.	Legislature, ANR, WG	Full basin
2) Identify groups of vernal pools that are particularly significant or likely to maintain hydrology and habitat connectivity and thus species presence in the face of climate change	VDEC – Wetlands	ANR	Full basin
3) Identify areas to prioritize vernal pool protection and possible consideration for Class One wetland complex	VDEC – Wetlands	ANR	Full basin

Objective 11: Assess high elevation wetlands in northern Deerfield watershed to provide data for BioFinder and RTE.			
Action	Partners	Potential Funding Sources	Implementation Location
Conduct wetland assessments	VDEC – Wetlands,	ANR	Dover, Wilmington, Searsburg, Somerset
Conduct bear surveys	VFWD	ANR	Same

Objective 12: Survey the Deerfield watershed and document waterfalls, cascades and gorges.*			
Action	Partners	Potential Funding Sources	Implementation Location
Conduct survey and map sites	DRWA, WRC	WG, 604(b), DREF	Deerfield watershed

Objective 13: Assess wetland complexes upstream of Wilmington for improved flood storage capacity.			
Action	Partners	Potential Funding Sources	Implementation Location
Map and model current and potential storage capacity	VDEC- Rivers Program & Wetlands	ANR	Wilmington

Objective 14: Conduct AEM assessments on the North Branch Deerfield upstream of Wilmington.			
Action	Partners	Potential Funding Sources	Implementation Location
Assess agricultural operations for environmental BMPs	WCNRCD, VACD, AAFM	VWG, ERP, AAFM	North Branch Deerfield

* The Deerfield River watershed was not included in the 1985 *The Waterfalls, Cascades and Gorges of Vermont*, by Jenkins & Zika

Protection and Restoration Projects

Basin-wide

Objective 15: Incorporate river corridors and flood resiliency strategies into local and regional development plans and zoning.			
Action	Partners	Potential Funding Sources	Implementation Location
Focus on areas of highest risk identified in River Corridor plans	RPC's, Town Planning and Conservation Commissions, VLCT	MPG	Basin-wide Basin-wide Focus Towns: Brattleboro, Wilmington, Dover, Vernon

Objective 16: Remove dams that are no longer serving a useful purpose.			
Action	Partners	Potential Funding Sources	Implementation Location
1) The Coop dam on Whetstone Brook	VDFW, VT Dam Task Force, USFWS	AR/NOAA, ERP, USFWS-EBTJV	42.850948, -72.557962
2) Cold Brook dam in Dover	VDFW, VT Dam Task Force, USFWS	AR/NOAA, ERP, USFWS-EBTJV	
3) Prioritize dams in *Poor* condition for removal potential	VDFW, VT Dam Task Force, USFWS	AR/NOAA, ERP, USFWS-EBTJV	

Objective 17: Identify, document and protect the natural communities(NC) and RTE species in significant wetlands, including Ryder Pond, prior to dam removals.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Survey and document NC and RTE in the Ryder Pond wetlands	VDEC – Wetlands, VDFW – NHP		Ryder Pond
2) Survey and document NC and RTE in wetlands above dam any proposed removal project	VDEC – Wetlands, VDFW – NHP		

Objective 18: Complete a wetland restoration following a dam removal.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Conduct training for staff and partners on dam removal and wetland restoration	Institute for Wetland & Environmental Education & Research, NRCS, VDEC - Wetlands	ERP, PFW, WRP/DU, USFWS, WG	
2) Complete the removal of the Ryder Pond dam	Ryder Pond Landowners Association	Ryder Pond Landowners Association	Ryder Pond 42.812828,-72.843178
3) Restore the functions of the remaining wetland	WRP/DU		

Objective 19: Use the WRC *Undeveloped Shorelands Maps*, to prioritize areas for protection on lakes, ponds, river and streams.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Prioritize most threatened sites	WRC, Watershed Assoc.	ANR, 604(b)	Basin-wide
2) Seek funding for purchase and easements	WRC, Municipalities, VRC	ERP,	Basin-wide

Objective 20: Implement stormwater control projects to reduce flows and sediment wherever possible. Focus area priority: outfalls to the North Branch Deerfield and its tributaries.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Conduct stormwater survey and IDDE investigations	VDEC - Stormwater	ERP	Dover, Wilmington, Whitingham, Readsboro
2) Develop and implement stormwater control projects	VDEC, Municipalities, Ski Resorts	ERP, private	Dover, Wilmington

Objective 21: Encourage and implement green infrastructure practices.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Encourage use of green stormwater infrastructure.	VDEC	VDEC	Basin-wide
2) Promote local regulatory approaches to encourage GSI and LID	VDEC	ERP, VAPDA	Basin-wide
3) Promote local incentives to support GIS and LID.	VDEC	ERP, VAPDA	

Objective 22: Monitor and document impacts of TS Irene.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Document erosion damage & mass failures	VGS, WRC, BCRC, SGA Consultants	604(b)	Basin-wide
2) Document infrastructure problems and concerns	WRC, BCRC, VTrans, SGA Consultants	604(b)	Basin-wide

3) Develop remediation projects where appropriate	WRC, BCRC, SGA Consultants	604(b), BBR	Basin-wide
4) Update delineated SGA and FEH corridors where river has migrated outside of boundary	VDEC – Rivers Program	ANR	Where applicable

Objective 23: Better manage lakeshore and water quality issues on lakes and ponds in the Basin.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Promote and initiate the Lake Wise program	VDEC – Lakes & Ponds, Lake Assoc.		Lake Raponda, Sadawga Lake, Lily Pond, Hidden Lake
2) Coordinate with LID staff on lakeshores and retrofitting systems	VDEC – Lakes & Ponds & Stormwater, Lake Assoc.	ERP, BBR	
3) Establish conservation programs for lakeshores	VDEC – Lakes & Ponds, WRC, BCRC, VRC	VRC, VHCB, ERP	Lake Raponda, Sadawga Lake, Shippee Pond, Lily Pond, Hidden Lake
4) Conduct invasives evaluation and protection programs on the lakes	VDEC – Lakes & Ponds, Lake Assoc.		Lake Raponda, Sadawga Lake, Shippee Pond, Lily Pond, Hidden Lake, Grout Pond, Jacksonville Pond, Weatherhead Hollow Pond, South Pond
5) Expand Lay Monitoring program to more Basin lakes	VDEC – Lakes & Ponds, Lake Assoc.		All but Lake Raponda
6) Establish a monitoring and control program on Sadawga Lake to reduce the levels of Eurasian watermilfoil.	LSA	ANS Grant-in Aid	Sadawga Lake
7) Work with lakes subject to annual drawdown to eliminate these impacts	VDEC – Lakes & Ponds, Lake Assoc.		Where applicable

Objective 24: Encourage and support smart growth development and compact village centers and downtowns to slow forest fragmentation.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Promote ACCD programs.	VDEC	VDEC	Basin-wide, focus areas: resort development, Brattleboro, Wilmington, Dover
2) Identify high-priority landscapes for conservation efforts.	ANR		

Objective 25: Dovetail continued post-closure monitoring programs of landfills with working on fixes for known water quality impacts following the end of the required monitoring in 2013.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Maintain water monitoring programs	VDEC - WMD	SWAG - CPP	Municipal landfills in Brattleboro, Dover, Halifax, Searsburg, Wilmington
2) Develop and implement clean-up projects at impacted locations	VDEC - WMD	SWAG - CPP	

Objective 26: Reduce sand and sediment inputs from gravel roads throughout the Basin.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Provide more training and education for road agents on preventing erosion	Local Roads, Municipal DPW's, RPCs	Local Roads	Basin-wide
2) Conduct BBR capital budget inventories for road-related erosion, AOP impediments, and river-road conflicts with an emphasis on flood resiliency	Focus towns, Better Backroads technician, VDEC	BBR, ERP	Brattleboro, Dover, Guilford, Halifax, Whitingham, Wilmington
3) Seek funding for regionally shared equipment for sand sweeping, catch basin sump cleaning and reduced use of sand &	Focus towns, Better Backroads technician, VDEC	BBR, 319, VTrans	Brattleboro, Dover, Guilford, Halifax, Whitingham, Wilmington

salt with possible conversion to brine			
3) Relocate or cover town sand pile storage area	VDEC, Guilford DPW	319	Guilford, Broad Brook
4) Conduct an assessment of water quality impairments associated with Class IV town roads using the model developed for the White River Basin.	VDEC, Towns, WRC, VDFPR, Better Backroads	ERP, BBR	Basin-wide
5) Reduce the amount of sediment and other pollutants associated with Class IV town roads.	Towns, WRC , Better Backroads, VDEC, VDFPR , VYCC	ERP, DREF, VYCC, Hazard Mitigation Grant Program	Basin-wide

Objective 27: Work to improve fisheries and fish habitat throughout the Basin.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Implement habitat improvement projects on Whetstone, Broad, Newton and Crosby Brooks	VDFW, TU, CRWC	WG, ERP	Whetstone, Broad, Newton, Crosby Brooks

Objective 28: Reduce non-point source pollutants from farming operations by implementing BMPs on farms.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Conduct AEM assessments and AOI visits to all livestock farms in focus area	WCNRCD, AAFM	AAFM, WG, ERP	Deerfield watershed: North Branch, lower Deerfield & North River, Hinesburg Brook CTR watershed: CTR mainstem, Newton, Whetstone, Broad, Crosby Brooks
2) Coordinate referrals of potential program staff	WCNRCD, BCCD, VACD, AAFM, NRCS		
3) Implement BMP's on prioritized critical source areas	WCNRCD, BCCD, VACD, AAFM, NRCS	EQIP, CREP, AAFM, PFW, WHIP, WRP/DU, 319	

Objective 29: Reduce non-point source pollutants from farming operations by sharing machinery regionally.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Survey interest of area farmers	WCNRCD	WG	Basin-wide
2) Seek funding for regionally shared equipment for manure incorporation, pasture inter-seeding & ag plastic recycling	WCNRCD, BCCD, VACD, AAFM, NRCS	AAFM, ERP, EQIP, FSA, NRCS, 319	
3) Coordinate rental / reservation program for sharing equipment	WCNRCD, BCCD		

Objective 30: Reduce non-point source pollution associated with logging operations by implementing AMPs and by promoting the use of portable skidder bridges.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Continue the AMP Monitoring Program administered by DFPR	VDFPR, DEC Compliance and Enforcement Division, Vermont Forest Products Association	State General Funds	Basin-wide
2) Support the Portable Skidder Bridge Rental Program	Windham & Bennington County NRCD, VDFPR	ERP	Basin-wide

Objective 31: Monitor for invasive tree pests (i.e. hemlock wooly adelgid and emerald ash borer) that could impact forest health and sustainability, and support community preparedness planning.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Support the Forest Pest First Detector Program.	VDFPR , UVM Extension	State General Funds	Basin-wide
2) Support municipalities to prepare for invasive tree pests.	VDFPR , UVM Extension	ERP	Basin-wide

Objective 32: Improve planning and management of the urban tree canopy.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Promote the planning and management of urban tree canopy to municipalities.	VDFPR , UVM Extension	VDFPR , USFS	Urban areas Focus: Brattleboro, ski resorts
2) Promote the benefits of trees and forests for water quality.	VDFPR , UVM Extension	VDFPR , USFS	Basin-wide
3) Encourage participation in the Stewardship of the Urban Landscape - Tree Stewards course	VDFPR , UVM Extension	VDFPR , USFS	Basin-wide

Deerfield River

Objective 33: Protect the current high quality waters in the Deerfield watershed through reclassification and ORW designations.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Submit Class A reclassification proposals for all waters identified in Table 10	VDEC – MAPP		
2) Submit ORW designation proposals for all waters identified in Table 13	VDEC – MAPP		
3) Evaluate wetlands identified in Table 14 for Class 1 potential	VDEC – Wetlands, watershed groups, MAPP, VDFW, VDFPR		
4) Submit Class 1 reclassification proposals for the wetland if it meets the criteria	VDEC – Wetlands, watershed groups, MAPP, VDFW, VDFPR		

Objective 34: Work with the TransCanada to address river impacts related to temperature on the Deerfield River listed in Part F.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Summarize and present data	VDEC, USFS, TransCanada	TransCanada	Below the Harriman Reservoir
2) Develop & implement mitigation strategies	VDEC, TransCanada, USFS	TransCanada	Below the Somerset Reservoir(from fisheries)

Objective 35: Work with VDFPR, VDFW, the Town of Vernon and local partners to evaluate Atherton Meadows pond and wetland and Vernon's black gum wetlands for potential Class 1. reclassification.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Condust evaluations	DEC Wetlands, VDFPR, VDFW, the Town of Vernon, local partners		
2) Develop and implement management goals	VDEC – MAPP, DEC Wetlands, VDFPR, VDFW, the Town of Vernon, local partners		
3) Seek reclassification if criteria are met	VDEC – MAPP, DEC Wetlands, VDFPR, VDFW, the Town of Vernon, local partners		

North Branch Deerfield River

Objective 36: Develop and implement the WQRP for Mount Snow resort to address stormwater impairment and altered flows as listed in Parts A & F.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Review Master Plan and Framework and develop remediation plan & projects	Mt Snow Resort, Act250, VDEC	Private	
2) Work with resort to implement projects	Mt Snow Resort, Act250, VDEC	Private	North Branch Deerfield & tribs
3) Disconnect Snow Lake from the North Branch Deerfield and restore stream channel	Mt Snow Resort	private	Snow Lake
4) North Branch	Mt Snow Resort, Dover	Private, BBR	North Branch
5) Iron Stream trib.	Mt Snow Resort	Private	Iron Stream trib.

Objective 37: Work with the Mount Snow resort, the towns of Dover & Wilmington and the community to address high *E. coli* levels causing impairments to the North Branch of the Deerfield River.			
Action	Partners	Potential Funding Sources	Implementation Location
Implement bacteria mitigation practices identified in the TMDL	Mt Snow Resort, Towns of Dover & Wilmington	SWAG – CPP, CWSRF	Impaired reach of No. Branch

Connecticut River

Objective 38: Implement recommendations of the LIS-TMDL to reduce point source nitrogen (N) loads by 25%.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Identify sources and implement reduction practices	Municipal WWTFs, industrial N dischargers	CWSRF	See Section 2.6

Objective 39: Implement recommendations of the LIS-TMDL to reduce non-point source nitrogen loads by 10%.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Educate ag producers on N reduction practices	AAFM, NRCS, NRCDs, ag producers		Basin-wide
2) Implement appropriate practices including: • Increased soil testing & Nutrient Management Planning • Timed fertilizer application • Needs based N application rates • Use of cover crops & perennial grasses • Extended rotation periods	AAFM, NRCS, NRCDs, ag producers	EQIP, AAFM, VACD, CREP	Basin-wide

• Install wood chip filter beds/trenches to treat drainage water • Increased riparian buffers			

Objective 40: Work with the TransCanada, through the FERC relicensing process, to address river impairments related to flow issues on the Connecticut River listed in Part F -Waters Altered by Flow Regulation.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Above and below the Vernon Dam	TransCanada, FERC, USFWS, NHFG, TNC, CRWC, others	TransCanada	CT River, above and below the Vernon Dam
2) Below the Bellows Falls Dam	Same	TransCanada	CT River, below the Bellows Falls Dam

Objective 41: Preserve existing and create more floodplain along the Connecticut River.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Assess current floodplain quantity & capacity	TNC	WG	
2) Seek RCE opportunities	CRWC, CRJC	ERP	
3) Seek floodplain reconnection and restoration opportunities	TNC, CRWC, CRJC	ERP	

Objective 42: Protect the land and habitat along the Connecticut River to enhance survival of the high concentration of RTE species.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Focus efforts in Vernon & Brattleboro	USFWS – Conte Refuge, VRC	USFWS, PFW, CREP, WHIP	Vernon & Brattleboro
2) Control the spread of invasive species identified by the Connecticut River Invasive Aquatic Species Project that degrade	Connecticut River Invasive Aquatic Species Project		

native floodplain and riparian habitat			

Objective 43: Control aquatic invasive species in the Connecticut River.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Water chestnut in Vernon Dam impoundment	SeVWA, CRJC-LRS, USFWS – Conte Refuge	ANS Grant-in Aid	Vernon 42.779779,-72.508396
2) Focus species: Eurasian watermilfoil, curly leaf pondweed, Japanese knotweed, European Naiad		ANS Grant-in Aid	all boat access points

Objective 44: Evaluate the Black Gum Swamp wetlands for potential Class 1 reclassification.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Conduct evaluation	VDEC – Wetlands, watershed assoc.		
2) Submit Class 1 reclassification proposals for the wetland if it meets the standards	VDEC – Wetlands Town of Vernon		Maynard Miller Memorial Town Forest

East Branch North River

Objective 45: Conduct a Stream Geomorphic Assessment of the river.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Include Branch and Hager Brooks	WCNRCD, WRC	ERP	
2) Partner with Massachusetts to assess the lower river	DRWA, RPCs	ERP, DREF	

Objective 46: Protect the Halifax Gorge.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Pursue ORW designation			42.743262, -72.735191

2) Consider a public access easement	VRC	ERP	

Green River

Objective 47: Complete the Stream Geomorphic Assessment of the full river.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Implement priority projects in the Corridor Plan	WCNRCD, WRC	ERP, DREF	TBD
2) Partner with Massachusetts to assess the lower river	DRWA, RPCs	ERP, DREF	

Objective 48: Work to prevent the further spread of Japanese knotweed in the watershed.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Continue pulling workshops and outreach.	Conservation Commissions, WCNRCD	ANS Grant-in Aid, WG, WHIP	

Objective 49: Investigate if the Green River could be considered for "Wild & Scenic" status.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Review resources & requirements for W&S	FGR, DRWA	WG, DREF	
2) Pursue if appropriate	FGR, DRWA	WG, DREF	

Objective 50: Formalize public access sites in appropriate areas.			
Action	Partners	Potential Funding Sources	Implementation Location
Locate & pursue current access points without formal agreements	VRC, DRWA, VDFPR, VFWD	ERP, DREF,	

Objective 51: Consider removing the dam on Pond Brook off Jelly Mill Rd, Guilford north of Gallup Pitch Rd.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Contact landowner	VDTF		

2) Pursue removal if appropriate	VDTF	AR/NOAA	approx. 42.764859, -72.669357

Fall River

Objective 52: Protect and enhance wildlife crossing access across I-91.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Assess AOP and terrestrial crossing opportunities in this very important RTE corridor	VTrans, VDFW, Conservation Commissions	WG, Enhancement, Structures, USFWS AOP	
2) Implement crossing improvement opportunities	VTrans, VDFW, Conservation Commissions	Enhancement, Structures, USFWS AOP	

Objective 53: Work with DFPR on the water quality and habitat aspects of the re-filling or wetland restoration of Sweet Pond.			
Action	Partners	Potential Funding Sources	Implementation Location
Coordinate with VDFPR	VDEC – MAPP & Wetlands, VDFW	ANR	Sweet Pond

Crosby Brook

Objective 54: Reduce sediment impacts to Crosby Brook.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Enlarge the capacity of the C&S stormwater pond	C&S, VDEC-Stormwater	private	42.892878, -72.550964
2) Address the mass failure on Black Mountain Rd.	WCNRCD, VDEC-Rivers	ERP	42.885587, -72.565995
3) Address erosion on Black Mountain Rd.	Town of Brattleboro	BBR	
4) Implement priority projects from the Corridor Plan	WCNRCD, WRC, Towns of Brattleboro & Dummerston	ERP, WG	
5) Implement priority projects from Putney Road Restoration Study	AOT, Town of Brattleboro	Enhancement, ERP, WG, Windham Fdn	Ryan Road to Landmark Hill Driver

Project			
6) Address erosion on gravel roads	Towns of Brattleboro & Dummerston	BBR, ERP	

Objective 55: Replace or retrofit structures prioritized in the Crosby Brook Corridor Plan.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Ryan Road	Town of Dummerston	BBR, ERP	42.899759, -72.551597
2) Middle Road (upper)	Town of Dummerston	BBR, ERP	
3) Black Mountain Road	Town of Brattleboro	BBR, ERP	42.88317, -72.563421
4) Dickinson Road	Town of Brattleboro	BBR, ERP	42.888716, -72.569686

Objective 56: Encourage Low Impact Development (LID) by offering development density incentives for those projects which result in reduced footprints of impervious cover.			
Action	Partners	Potential Funding Sources	Implementation Location
Implement zoning bylaws allowing greater residential densities with the implementation of LID techniques.	RPCs, Towns, WSMD – Stormwater, VLCT	604(b)	

Whetstone Brook

Objective 57: Implement recommendations of the Whetstone Brook Bacteria TMDL to control high levels of bacteria.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Pursue and address failing or malfunctioning onsite septic systems	Town DPW, SeVWA, property owners	WG, ERP, CWSRF	Watershed-wide
2) Pursue and address leaking sanitary sewer pipes a) Begin testing for sanitary sewer leaks in the downtown area	Town DPW	CWSRF	Brattleboro
3) Pursue and address stormwater runoff from developed areas	Town DPW, SeVWA, property owners	ERP, WG	Brattleboro, West Brattleboro

4) Pursue and address illicit discharges	Town DPW	CWSRF, ERP	Brattleboro, West Brattleboro
5) Expand citizen education about the negative impacts of stormwater, with a focus on the importance of picking up after one's pet.	SeVWA, WCNRCD	WG	Watershed-wide
6) Support programs that assist with the replacement or upgrading of failed onsite septic systems or expansion of the municipal wastewater system to reach more residences.	Town DPW	CWSRF	Watershed-wide

Objective 58: Protect remaining floodplain and flood capacity in the watershed.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Develop appropriate regulations to protect lands within the identified floodplain and FEH zone.	RPC's, Town Conservation and Planning Commissions	604(b), MPG	Brattleboro, esp. West Brattleboro, Marlboro
2) Encourage landowners to install buffers, and other tools that protect shoreline and/or riparian areas.	WCNRCD, NRCS, AAFM	T4S, CREP, WHIP, AAFM, ERP	Watershed-wide
3) Seek to enhance buffers through a combination of buffer plantings, land conservation, and incentive programs.	WCNRCD, NRCS, AAFM	T4S, CREP, WHIP, AAFM, ERP	Watershed-wide

Objective 59: Remove Tri-Park trailers in Mountain Home Park that are under agreement to be removed from the floodway.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Coordinate development of Tri-Park Master Plan to relocate homes	VDEC – RMP, Town Planning Services Dept., Tri-Park Cooperative	CDBG, MPG	Mountain Home Park
a) Priority sites: Winding Hill Rd., Brookwood Dr., and Village Dr.			
b) include relocation schedule & funding sources			
2) Obtain planning grants to fund Master Plan development	Town Planning Services Dept.	CDBG, MPG	
3) Remove 51 trailers from the floodplain		HMGP	
4) Remove the berm and other structure that limit floodplain access		ERP	

Objective 60: Implement Better Backroads projects along the brook.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Focus areas include: Hamilton Rd., Bonnyvale Rd., Guilford Rd. & Sunset Lake Rd.	Town DPWs	BBR	

Broad Brook

Objective 61: Reduce sand and sediment inputs to Broad Brook.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Work with Town to improve sand pile storage	Town DPW	Enhancement	Guilford
2) Work with Town to reduce gravel road runoff	Town DPW	BBR	
3) Complete a Road Inventory and Capital Budget Plan	Town DPW	BBR	

Newton Brook

Objective 62: Develop an implementation plan to address the sediment impairment in Newton Brook.			
Action	Partners	Potential Funding Sources	Implementation Location
1) Coordinate plan development	VDEC, AAFM, NRCDs	ANR, AAFM, WG, ERP	
2) Implement plan strategies	VDEC, AAFM, NRCDs, NRCS	319, EQIP, CREP, ERP	
3) Seek to enhance buffers through a combination of buffer plantings, land conservation, and incentive programs	WCNRCD, NRCS, AAFM	T4S, EQIP, CREP, WHIP, AAFM, ERP	
4) Implement Better Backroads projects	Municipalities	BBR	

Potential Funding Sources			Partners	
319	Clean Water Act Sec. 319		BCCD	Bennington County Conservation District
604(b)	Clean Water Act Sec. 604(b)		BCRC	Bennington County Regional Commission
AAFM	VT Agency of Agriculture, Food & Markets cost-share programs		Con. Comm.	Town Conservation Commission
ANR	ANR budget		CRJC	Connecticut River Joint Commissions
ANS Grant-in Aid	Aquatic Nuisance Species Grant-In-Aid Program		CRWC	Connecticut River Watershed Council
AR/NOAA	American Rivers/National Oceanic & Atmospheric Administration		CTR.us	ConnecticutRiver.us
BBR	Better Backroads Program grant - VTrans		DRWA	Deerfield River Watershed Association
CDBG	Community Development Block Grant		FEMA	Federal Emergency Management Agency
CREP	Conservation Reserve Enhancement Program		FGR	Friends of the Green River
CWSRF	State Revolving Loan Fund - Clean Water State Revolving Loan Fund		FSA	USDA-Farm Service Agency
ECF	Environmental Contingency Fund		LRA	Lake Raponda Association
Enhancement	VTrans Enhancement grant		LSA	Lake Sadawga Association
EQIP	Environmental Quality Incentive Program		NRCD	Natural Resources Conservation District
ERP	Ecosystem Restoration Program grant - DEC		NRCS	USDA - Natural Resources Conservation Service
FEMA HMG	FEMA Hazard Mitigation Grant		SeVWA	Southeastern Vermont Watershed Alliance
GI	Green Infrastructure Municipal Outreach Project		SVNHM	Southern Vermont Natural History Museum
GMNFS	Green Mountain National Forest - USFS		TC	TransCanada Corp.
LARC	Land Acquisition Review Committee - VDFPR		TNC	The Nature Conservancy
LaRosa	Analytical Services Partnership grants		Town	Municipal Government body
Local roads	VT Local Roads Program		USDA	US Dept of Agriculture

Potential Funding Sources			Partners	
MPG	Municipal Planning grant		USFS	USDA- Forest Service
PFW	USFWS - Partners for Fish & Wildlife		USFWS	US Fish & Wildlife Service
Structures	VTrans Structures grant		VANR	VT Agency of Natural Resources
SWAG - CPP	Solid Waste Assistance Grants - Community Pollution Prevention		VAPDA	Vermont Association of Planning and Development Agencies
USFS	USDA- Forest Service grant		VDEC	VT Dept of Environmental Conservation
USFWS AOP	US Fish & Wildlife Service - Aquatic Organism Passage grant		VDFPR	VT Dept of Forests, Parks and Recreation
USFWS-EBTJV	US Fish & Wildlife Service - Eastern Brook Trout Joint Venture		VDTF	VT Dam Task Force
VHCB	VT Housing & Conservation Board		VFWD	VT Fish and Wildlife Dept
VRWA	Vermont Rural Water Association		VGS	VT Geographic Survey
ERP	Watershed (License Plate) grant		VRC	VT River Conservancy
WHIP	Wildlife Habitat Incentive Program		VTrans	VT Agency of Transportation
WRP/DU	NRCS Wetland Reserve and DU funding		Watershed Assoc.	Local watershed associations
			WCNRCD	Windham County Natural Resources Conservation District
			WRC	Windham Regional Commission

Tri-State Marker in Water at Vernon 1970

Appendices

Under separate cover

Abbreviations List

319	Federal section 319 grants for NPS pollution abatement
604b	Federal section 604b pass through funds
AAFM	Vermont Agency of Agriculture Food and Markets
ALS	Aquatic Life Support
ANR	Vermont Agency of Natural Resources
ANS	Aquatic Nuisance Species Program
AOP	Aquatic Organism Passage
AR	American Rivers
BASS	Biological Assessment Studies Section
BBR	Better Backroads
BMP	Best Management Practices
CDBG	Community Development Block Grant
CREP	Conservation Reserve Enhancement Program
CRJC	Connecticut River Joint Commissions
CRWC	Connecticut River Watershed Council
CWSRF	Clean Water State Revolving Fund
DREF	Deerfield River Enhancement Fund
DRWA	Deerfield River Watershed Association
ENVY	Entergy Vermont Yankee Nuclear Power Facility
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ERP	Ecosystem Restoration Program
FEH	Fluvial Erosion Hazard
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GMNF	Green Mountain National Forest
GSI	Green Stormwater Infrastructure
HMGP	Hazard Mitigation Grant Program
IDDE	Illicit Discharge Detection and Elimination
LaRosa	LaRosa Analytical Partnership Program
LID	Low Impact Development
LIS	Long Island Sound
MAPP	Monitoring, Assessment and Planning Program
MGD	million gallons per day
MPG	Municipal Planning Grants
NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
NPS	Nonpoint Source Pollution

NRCD	Natural Resources Conservation District
NRCS	Natural Resource Conservation Service
ONRCD	Ottauquechee Natural Resource Conservation District
ORW	Outstanding Resource Water
PFW	Partners for Fish and Wildlife Program
RMP	River Management Program (Agency of Natural Resources)
RPC	Regional Planning Commission
RTE	Rare, Threatened and Endangered species
SeVWA	Southeast VT Watershed Association
SGA	Stream Geomorphic Assessment
T4S	Trees For Streams
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TU	Trout Unlimited
USF&W	United States Fish and Wildlife Service
USFS	United States Forest Service
USGS	United States Geological Survey
UVM Ext	University of Vermont Extension
VDEC	Vermont Department of Environmental Conservation
VDFPR	Vermont Department of Forest Parks and Recreation
VDFW	Vermont Department of Fish and Wildlife
VDOH	Vermont Department of Health
VHCB	Vermont Housing and Conservation Board
VHQW	Very High Quality Water
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VRC	Vermont River Conservancy
VTrans	Vermont Agency of Transportation
VWQS	Vermont Water Quality Standards
VYCC	Vermont Youth Conservation Corps
WCNRCD	Windham County Natural Resources Conservation District
WHIP	Wildlife Habitat Enhancement Program
WMA	Wildlife Management Area
WQRP	Water Quality Remediation Plan
WRC	Windham Regional Commission
WSMD	Watershed Management Division
WWTF	Wastewater Treatment Facility

Glossary

A full glossary is available in the Vermont Surface Water Management Strategy Glossary.

Stressed - Water quality and/or aquatic habitat at risk or somewhat diminished, but standards are met.

Head Cut (stream geomorphology) - an erosional feature of some intermittent streams and perennial streams where an abrupt vertical drop, also known as a knickpoint in the stream bed occurs. The knickpoint, where a head cut begins, can be as small as an overly-steep riffle zone or as a large as a waterfall. When not flowing, the head cut will resemble a very short cliff or bluff. A small plunge pool may be present at the base of the head cut due to the high energy of falling water. As erosion of the knickpoint and the streambed continues, the head cut will migrate upstream.(http://en.wikipedia.org)

Water Quality Remediation Plan - a TMDL alternative in which pollutant sources stressing a waterbody (normally non-point sources) are identified and remediation actions believed sufficient to alleviate the problem are rapidly installed. Actions are usually tied to a completion timeline as well as follow-up monitoring to track improvement and success. WQRPs have been instituted as part of Act 250 permit requirements and 1272 Orders and are usually sufficient to preclude the development of a TMDL according to EPA regulations (i.e. 4b alternative). Oftentimes WQRPs are preferable to TMDLs because much of the modeling and loading estimate work, which can be complex and time consuming, is skipped to enable rapid assessment and deployment of BMPs.